IOGC '95
September 24 - 26 1995

Indian Oil & Gas Conference

India: Asia's Emerging Oil Giant

TAJ PALACE INTER-CONTINENTAL, NEW DELHI, INDIA

The Honourable Minister of State for Petroleum & Natural Gas, Government of India, Captain Satish Sharma

Co-Conference Chairmen Dr. Fereidun Fesharaki, Director, Program on Resources, East-West Center, Honolulu.
Dr. R.K Pachauri, Director, Tata Energy Research Institute, New Delhi

ng Committee

tary:

K Batra
ır, Tata Energy Research
e

M B Baruah
ıan & Managing Director
igaon Refinery &
hemicals Ltd

C. Bora
ıan & Managing Director
ıa Limited

it C Kapadia
jing Director
ıtan Oil Exploration
ı

K. Manglik
ıan
l Natural Gas
ation Ltd

ıram Singh Mehta
ıng Director
ıell Group of
ınies in India

K. Narang
ıan
)il Corporation Ltd

A Pathan
ır (Marketing)
Oil Corporation Ltd

shi Ruia
ıan

R. Setlur
ır
ce Petroleum Limited

jendra Singh
ıan & Managing Director
al Thermal Power Corp

Sundararajan
ıan & Managing Director
Petroleum Corpn Ltd

S. Venkatareman
ır (Technical)
ers India Ltd.

rence Organization:

nla Mulchand *L L B (Hons)*
ng Director
nference Connection Inc

WELCOME FROM THE CO-CONFERENCE CHAIRMEN
INDIAN OIL AND GAS CONFERENCE (IOGC '95)
DR FEREIDUN FESHARAKI AND DR R.K. PACHAURI

September 24 1995

On behalf of the organisers and the Steering Committee, a warm welcome is extended to all distinguished speakers and participants attending the inaugural IOGC '95 in New Delhi. This is the first event of its kind being hosted in India, which we hope to repeat on a regular basis

We are delighted to have more than 250 participants from 25 nations, representing key organisations in oil and gas, shipping and financial sectors. The level of interest and the status of participation of market makers and movers, underscores the importance of India for the world oil markets. We believe IOGC '95 is a very timely opportunity to review some of the exciting and far reaching changes that are taking place in India's oil industry.

Many critical issues affecting the oil and gas industry will be discussed at the conference and we are fortunate to have more than 40 of the most distinguished figures from the international oil industry as speakers. We hope all participants will find conference sessions informative and thought provoking and find the next three days a useful opportunity to establish business contacts

Special thanks are extended to the IOGC '95 Steering Committee for their support, and to conference sponsors for their invaluable support and assistance to IOGC '95

Tata Ener

Fereidun Fesharaki
Director
Program on Resources
East West Center, Hawaii

R.K. Pachauri
Director
Tata Energy Research
Institute, New Delhi

Co-Organised by:

The Conference Connection Inc
P O Box 1736, Singapore 9117
Tel (65) 358 0960/61
Fax (65) 358 0962

&

Tata Energy Research Institute
Darbari Seth Block, India Habitat Centre
Lodi Road, New Delhi-110003
Tel. (9111) 462 2246
Fax (9111) 462 1770

Supported by:

The East-West Center
Program on Resources

&

International Association for Energy Economics

The First Annual

Indian Oil & Gas Conference

24 to 26 September 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

INFORMATION FOR DELEGATES

This folder contains all the information you will require We hope you will utilise the conference documentation which contains speaker presentation material to its best effect This material and your own notes will provide an excellent reference source However, written permission of the organisers and speakers will be needed for reproduction

Participants are advised to take full advantage of the time allocated for questions and discussion at the end of each session Additionally, the refreshment breaks will allow for the opportunity to meet and interact with other delegates

The following information will be useful

Conference Badges	For security reasons you must be registered and issued with a name tag **There will be no entry to the Conference and Exhibition area for people not wearing IOGC'95 Badges.**
Pre-registration time	2 00pm to 6 00pm September 24 at the Durbar Hall Foyer Taj Palace Inter-Continental Hotel 7 00am to 8 00am September 25 at the Durbar Hall Foyer, Taj Palace Inter-Continental Hotel
Conference Sessions	The Sessions will be held in The Durbar Hall
IOGC Exhibition	The Exhibition will be held in The Mumtaz Mahal from 8 00 to 6 00 pm on September 25 and 26 1995
The Opening Reception	The Opening Reception hosted by **Bharat Shell Limited (a joint venture between Bharat Petroleum Corp & Shell Overseas Investment B.V.)** will be held at the Shahjehan 6 00 pm to 8 00 pm on September 24 1995

Lunches	12 00 - 1 30pm at The Shahjehan on 25 September 1995 Hosted by **Caltex Petroleum Corporation** 12 00 - 1 30pm at The Shahjehan on 26 September 1995 Hosted by **Oman Oil Company Inc**
Tea & Coffee Breaks	Coffee Breaks will be at the Durbar Hall Foyer
Conference Dinner	The Conference Dinner being jointly hosted by **The International Petroleum Exchange of London Limited** and **Singapore International Monetary Exchange Limited**, will be held at the **Rani Bagh from 7.30 pm 25 September 1995.**
Messages	Please check the Message Board (located at the Durbar Hall Foyer) during breaks for any incoming messages

Conference Connection and the hotel staff representatives will be on hand to assist you at all times

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

"INDIA : ASIA'S EMERGING OIL GIANT"

BOUT IOGC ORGANISERS AND ENDORSERS

he Conference Connection Inc through its offices in the United States, Singapore and Australia pecialises in organising and managing high profile international meetings for the oil and gas industries orldwide Dedicated to providing an independent platform for interaction and discussion of the latest usiness and industry strategies, it strives to combine excellence and professionalism though linkage ith inter-governmental, professional and industry groups worldwide Other events being organised by ie group in 1995 include *Pacific Petroleum Insiders (PPI '95) in Singapore, the Fourth Annual iddle East Petroleum and Gas Conference (MPGC '96) in Bahrain and Trading and Hedging the sian Barrel, in Singapore*

he **Tata Energy Research Institute** (TERI) was established in 1974 as an autonomous non profit esearch organisation to address problems associated with the provision of adequate and sustainable nergy services for all in an equal and sustainable manner. It is based in New Delhi with regional units n Bangalore and Guwahati and staff strength of 275 professionals drawn from a broad range of isciplines TERI's wide ranging and multi disciplinary activities include Energy Environment nterface, Global Warming and Climate Change, Modelling and Policy Analysis and Conventional nergy Sources It has a specialised Information Centre which provides publications, software and nedia support to energy-environment institutions and scientists worldwid In 1990 TERI also stablished the Tata Energy and Resources Institute in Washington D C to further develop and trengthen linkages with institutions and organisations in North America

The **East-West Center** is an educational and research organisation established in Honolulu for over 30 years Its Program on Resources, studies energy and mineral industries at global and regional levels. The projects concentrate on international oil and gas markets and the downstream sectors The East-West Center is recognised as the leading source of analysis, data and strategic advisory services for Latin America, the Middle East and Pacific Rim

The **International Association for Energy Economics** (IAEE) is a key professional organisation representing energy executives and analysts around the globe. Founded in 1977, it provides a forum for the exchange of ideas, experience and issues in the energy field. IAEE has over 3000 members in 60 countries, with full affiliates in over 35 of these countries.
IAEE has an active programme of publications and conferences which attracts delegates representing influential government, corporate and academic energy decision makers.

IOGC '95
September 24 - 26 1995

Palace Inter-Continental,
New Delhi, India

THE FIRST ANNUAL

Indian Oil & Gas Conference

India: Asia's Emerging Titan

SEPTEMBER 24 - 26, 1995
TAJ MAHAL INTER-CONTINENTAL
NEW DELHI, INDIA

Under the Patronage of The Honourable Minister of State for Petroleum & Natural Gas, Government of India, Captain Satish Sharma

Conference Co-chairmen:

Dr Fereidun Fesharaki, Director, Program on Resources, East-West Center Hawaii
Dr R K Pachauri, Director, Tata Energy Research Institute, New Delhi

CONFERENCE SPONSORS

- Amoco Corporation, USA
- Bharat Shell Ltd
- Caltex Petroleum Corporation, USA
- Essar Oil Ltd., India
- International Petroleum Exchange of London, UK
- Oman Oil Company Inc, USA
- Punj Lloyd Ltd, India
- Singapore International Monetary Exchange Limited
- Smith New Court PLC, UK
- Unocal Corporation, USA

MEDIA SPONSORS:

- Energy Compass
- Petroleum Intelligence Weekly
- Petromin/Hydrocarbon Asia

RGANISERS AND ENDORSERS

Co Organised by

The Conference Connection Inc.

teri
Tata Energy Research Institute

Endorsed by

The East-West Center,
Program on Resources

IAEE
International Association For Energy Economics

Managed by

Conference Connection Administrators P/L

CONFERENCE AGENDA

Outlook for New Refining Capacity in India 1995 2005
- **Mr S N Jha**, Executive Director (Operations), Indian Oil Corporation Ltd, R & P Division, New Delhi, India

Indi[illegible]
- **Mr Everett Lewis** [illegible] Oman Oil Company Incs, Houston, USA

How International Investor View Indian Refining & Marketing Equities in a Regional Context
- **Mr Lars Rierson**, Equity Research Analyst, Morgan Stanley & Co, Singapore

10 00am to 10 30am — Morning Coffee

10 30am to 12 00pm — **PANEL SIX DOMESTIC MARKETING IN INDIA**

Panel Chairman
- **Mr Rajendra Singh**, Chairman and Managing Director National Thermal Power Corporation Ltd (NTPC), New Delhi, India

Panellists

Lubricants Marketing The Challenges Ahead
- **Mr Vikram Singh Mehta**, Managing Director Bharat Shell Ltd (a joint venture between Bharat Petroleum Corp & Shell Overseas Investments BV) Bombay India

LPG Supply, Demand & Infrastructure 1995 2005
- **Mr O N Marwaha** Executive Director LPG Indian Oil Corporation Ltd New Delhi India

Environmental Issues and Product Specification Changes
- **Mr A P Chaudhri** Executive Director Centre for High Technology New Delhi India

2 00pm to 1 30pm — Conference Luncheon II hosted by **Oman Oil Company Inc** at the **Shahjehan** with luncheon address on
Oman India Pipeline, A Project Overview
- **Mr Peter M Roberts**, Project Executive, Oman India Pipeline, Oman Oil Company Inc, Houston, USA

1 30pm to 2 45pm — **PANEL SEVEN OUTLOOK FOR CRUDE AND PRODUCT TRADI**

Panel Chairman
- **Dr Fereidun Fesharaki**, Director Program on Resources East West Center Hawaii USA

[illegible] Trading in Crude &
- **Mr S C Mathur** Director (Finance) Indian Oil Corporation Ltd New Delhi, India

Crude Pricing Mechanisms
- **Mr Peter Wildblood** Chief Executive International Petroleum Exchange of London Limited United Kingdom

Risk Management & Hedging Concepts Applications in the [illegible]
- **Mr I Madison Galbraith** Managing Director Commodity Advisory Service Group Merrill Global Commodities New York USA

2 45pm to 3 00pm — Afternoon Coffee

3 00pm to 4 45pm — PANEL EIGHT PERSPECTIVES INTERNATIONAL OIL COMPANIES

Panel Chairman
- **Mr R K Batra**, Advisor Corporate Sector Energy Research Institute New Delhi

Panellists

A Perspective on International Alliances Issues
- **Mr Steven K Welch**, Vice President International Business Development Amoco Petroleum Products Chicago USA

Fuel Cooking A tool for Many Crafts Ma[illegible] India
- **Mr Franz B Ehrhardt** Managing Director Frontier Business Development Director Operations, Conoco Inc Houston USA

4 45pm to 5 30pm — PANEL NINE INFRASTRUCTURE CHALLENGES

Panel Chairman
- **Dr Rakesh Mohan** [illegible] of Industry Government of India*

Panellists

Third Party Access to Pipeline [illegible]
- **Mr Thomas E Fisher** [illegible] Commercial Affairs Coastal States Gas Corporation USA

Pipeline Financing
- **Mr R A Shanbhag** Executive Director & Treasurer Indian Oil Corporation Ltd New Delhi India

Panellists

Port Location & Planning
- **Mr S Behuria** Executive Director Chennai Petroleum Corp Ltd Madras India

International Oil Storage Operations Planning
- **Mr Gerrit Stofregen** President Petrofac Pacific Ltd Hongkong

Refining Hope for Future Refining Margins Products 1995 2000
- **Mr Shanti Narain** Advisor Indian Oil Corporation Ltd New Delhi India*

5 30pm — **SUMMARY CONCLUSIONS AND CLOSE OF CONFERENCE**

Conference Co Chairman — Session to be chaired by **Dr Fereidun Fesharaki** and **Dr R K Pachauri**

STEERING COMMITTEE

Conference Co-chairmen — **Dr Fereidun Fesharaki**, Director, Program on Resources, East West Center Hawaii
Dr R K Pachauri, Director, Tata Energy Research Institute, New Delhi

Secretary — **Mr R K Batra**, Advisor, Corporate Sector, Tata Energy Research Institute, New Delhi

Mr J M B Baruah, Chairman and Managing Director, Bongaigaon Refinery & Petrochemicals Ltd
Mr B C Bora, Chairman and Managing Director, Oil and Natural Gas Corporation, Ltd
Mr Ajit C Kapadia, Managing Director, Hindustan Oil Exploration Ltd
Mr Vikram Singh Mehta, Managing Director, Bharat Shell Ltd (a joint venture between Bharat Petroleum Corp & Shell Overseas Investments B V)
Mr R K Narang, Chairman and Managing Director, Indian Oil Corporation Ltd
Mr M A Pathan, Director (Marketing) Indian Oil Corporation
Mr Shashi Ruia, Chairman, Essar
Mr S R Setlur, Director, Reliance Petroleum Ltd
Mr Rajendra Singh, Chairman and Managing Director, National Thermal Power Corporation
Mr U Sundararajan, Chairman & Managing Director, Bharat Petroleum Corporation Ltd
Dr R S Venkataraman, Director (Technical), Engineers India

Program and speakers are subject to change — *Pending final confirmation*

©Copyright The Conference Connection

CONFERENCE AGENDA

SUNDAY, SEPTEMBER 24, 1995

2.00pm to 6.00pm	Pre-Registration at the **Durbar Foyer**
6.00pm to 8.00pm	Opening reception hosted by **Bharat Shell Ltd** (a joint venture between Bharat Petroleum Corp & Shell Overseas Investments B V), at the **Shahjehan**, Taj Palace Inter-Continental

MONDAY, SEPTEMBER 25, 1995

7.00am to 8.45am	***Registration at the Durbar Foyer***

WELCOME AND INAUGURATION

8.45am to 9.00am	Conference Co-Chairmen's Welcome •**Dr Fereidun Fesharaki**, Director, Program on Resources, East-West Center, Hawaii, USA and •**Dr R K Pachauri**, Director, Tata Energy Research Institute, New Delhi, India
9.00am to 9.10am	***Welcome by*** •**Dr V L Kelkar**, Secretary, Ministry of Petroleum and Natural Gas, Government of India
9.10am to 9.30am	***Inaugural Address by*** •**Dr Manmohan Singh**, The Honourable Minister for Finance, Government of India
9.30am to 9.32am	Release of TLDDY - TERI Energy Data Directory & Yearbook 1995-96
9.32am to 9.35am	***Vote of thanks by*** •**Mr R K Batra**, Advisor, Corporate Sector, Tata Energy Research Institute, New Delhi, India
9.35am to 9.50am	*Coffee Break*

KEYNOTE ADDRESSES

9.50am to 10.45am	KEYNOTE ADDRESS - I **Deregulation: How Far and How Fast?** •**Dr V L Kelkar**, Secretary, Ministry of Petroleum and Natural Gas, New Delhi, India KEYNOTE ADDRESS - II •**Mr David J Law-Smith**, Chairman, President & CEO, Caltex Petroleum Corporation, Dallas, USA

10 45am to 12 00pm	**PANEL ONE: INDIA'S ROLE IN THE WORLD OIL MARKETS**
Panel Chairman	•**Dr Dennis J' O Brien**, Chief Economist, Caltex Petroleum Corporation, Dallas, USA
Panellists	**The International Energy Agency's View of World Oil Markets** •**Mr John P Ferriter**, Deputy Executive Director, International Energy Agency, Paris, France
	Product Demand Scenarios and Product Demand Forecasts for India •**Mr D C Lahiri**, Executive Director, Oil Coordination Committee, Ministry of Petroleum & Natural Gas, Government of India, New Delhi, India
	The Indian Oil Industry in the Global & Regional Context: Challenges Ahead •**Dr Fereidun Fesharaki**
12 00pm to 1 30pm	*Conference Luncheon I hosted by* ***Caltex Petroleum Corp*** *at* ***Shahjehan***
1 30pm to 2 45pm	**PANEL TWO: OUTLOOK FOR EXPLORATION AND UTILISATION OF OIL AND NATURAL GAS IN INDIA**
Panel Chairman	•**Mr Srinivasan**, Director (Exploration), Oil and Natural Gas Corporation, New Delhi, India
Panellists	**Gas Demand in India and Pipeline Transmission Infrastructure: 1995-2005** Mr R P Sharma, Executive Director (Planning & Marketing) Gas Authority of India Limited, New Delhi India
	Case Study of the Ravva Development Project •**Dr John Doran**, Managing Director Command Petroleum Ltd, Sydney Australia
	Iran-India Pipeline: Challenges & Prospects **Dr Narsi Ghorban** Associate Researcher, Institute for Political and International Studies Ministry of Foreign Affairs Islamic Republic of Iran
2 45pm to 3 00pm	*Coffee Break*
3 00pm to 4 00pm	**PANEL THREE: DEREGULATION AND PRIVATISATION IN ASIA: SOME PERSPECTIVES**
Panel Chairman	•**Mr R K Narang**, Chairman and Managing Director, Indian Oil Corporation Ltd, India
Panellists	**Malaysia's Perspective** •**Mr Shamsul Azhar Abbas**, Senior General Manager, Corporate Planning & Business Development, Petronas, Kuala Lumpur, Malaysia
	Oil Market Deregulation in Thailand •**Mr Prasert Bunsumpun**, Senior Vice President, Downstream Oil Business Marketing, Petroleum Authority of Thailand, Bangkok

4 00pm to 5 30pm — **PANEL FOUR: FINANCING OIL AND GAS PROJECTS IN INDIA**

Panel Chairman

•**Mr R N Malhotra**, Chairman, Indian Council for Research and International Economic Relations, New Delhi

Reform & Restructuring in the Hydrocarbon Sector
•**Dr Anil K Malhotra**, Energy Advisor for Asia, The World Bank, Washington D C , USA

The Role of International Equity Markets in Supplying Capital for the Oil Industry
•**Mr David M Gray**, Equity Capital Markets Director, HSBC Investment Bank, London, UK

Financing of Oil and Gas Projects with Special Reference to Project Finance
•**Mr Anthony M Dols**, Senior Vice President & Senior Relationship Manager, Natural Resources, ABN Amro Bank N V , Amsterdam, The Netherlands

Financing Oil and Gas Projects in India
•**Dr Chong Serp Chung** Senior Project Specialist, Asian Development Bank, Manila, Philippines

•**Dr A Bhattacharya**, Economic Advisor, Oil and Natural Gas Corporation, New Delhi, India

5 30pm — *Close of Day One*

7 30pm — *Dinner hosted by International Petroleum Exchange of London at the Rani Bagh, Taj Palace Inter-Continental*

TUESDAY, SEPTEMBER 26, 1995

8 30am to 10 00am — **PANEL FIVE: OUTLOOK FOR NEW REFINING CAPACITY**

Panel Chairman

•**Mr Prabir Sengupta** Advisor (Energy), Planning Commission, Government of India

Panellists

Technology Upgradation of Indian Refineries
•**Mr Shiv Naram Mathur** Director (Production) Hindustan Petroleum Corporation Ltd Bombay, India

Outlook for New Refining Capacity in India, 1995-2005
•**Mr S N Jha** Executive Director (Operations), Indian Oil Corporation Ltd, R & P Division, New Delhi, India

India Refining: A Foreign Investor's Perspective
•**Mr Everett Lewis**, Refinery Project Executive, Oman Oil Company Inc , Houston, USA

How International Investors View Indian Refining & Marketing Equities in a Regional Context
•**Mr Lars Reierson** Equity Analyst, Morgan Stanley & Co, Singapore

10 15am to 10 30am	*Morning Coffee*
10 30am to 12 00pm	**PANEL SIX: DOMESTIC MARKETING IN INDIA**
Panel Chairman	•**Mr Rajendra Singh**, Chairman and Managing Director, National Thermal Power Corporation Ltd (NTPC), New Delhi, India
Panellists	**Lubricants Marketing: The Challenges Ahead** •**Mr Vikram Singh Mehta**, Managing Director, Bharat Shell Ltd.(a joint venture between Bharat Petroleum Corp & Shell Overseas Investments B V), Bombay India
	LPG: Supply, Demand & Infrastructure 1995-2005 •**Mr O N Marwaha**, Executive Director (LPG), Indian Oil Corporation Ltd, New Delhi, India
	Environmental Issues and Product Specification Changes •**Mr A P Chaudhari** Executive Director, Center for High Technology New Delhi, India
12 00pm to 1 30pm	*Conference Luncheon II hosted by Oman Oil Company Inc at the* ***Shahjehan*** *with luncheon address on*
	Oman India Pipeline: A Project Overview •**Mr Peter M Roberts** Project Executive, Oman India Pipeline, Oman Oil Company Inc, Houston USA
1 30pm to 2 45pm	**PANEL SEVEN: OUTLOOK FOR CRUDE AND PRODUCT TRADE**
Panel Chairman	•**Dr Fereidun Fesharaki**
	Outlook for International Trading in Crude & Products: 1995-2005 •**Mr S C Mathur**, Director (Finance) Indian Oil Corporation Ltd, New Delhi, India
	Crude Pricing Mechanisms •**Mr Peter Wildblood**, Chief Executive, International Petroleum Exchange of London Limited, United Kingdom
	Risk Management & Hedging: Concept and Applications in the International Oil Markets •**Mr L Madison Galbraith**, Managing Director, Commodity Advisory Service Group, Merrill Lynch, Global Commodities, New York, USA
2 45pm to 3 00pm	*Afternoon Coffee*
3 00pm to 3 45pm	**PANEL EIGHT: PERSPECTIVES FROM INTERNATIONAL OIL COMPANIES**
Panel Chairman	•**Mr R K Batra**, Advisor, Corporate Sector, Tata Energy Research Institute, New Delhi
Panellists	**A Perspective on International Alliances: Drivers and Issues** •**Mr Steven K Welch**, Vice-President, International Business Development, Amoco Petroleum Products, Chicago, USA

	•Mr Franz B Ehrhardt Managing Consultant Frontier Business Development, Downstream Operations Conoco Inc, Houston, USA
3 45pm to 5 30pm	**PANEL NINE: INFRASTRUCTURAL CHALLENGES**
Panel Chairman	•**Dr Rakesh Mohan**, Economic Adviser, Ministry of Industry, Government of India
Panellists	**Third Party Access to Pipelines: the Case of the US and Lessons for India** •**Mr Thomas E Fisher**, Corporate Vice President, Commercial Affairs, Unocal Corporation, USA
	Product Pipelines •**Mr R A Shanbhag**, Executive Director (I/G) Pipelines, Indian Oil Corporation Ltd, New Delhi, India
Panellists	**Port Facilities & Imports** •**Mr S Behuria**, Executive Director (Sales), Bharat Petroleum Corp Ltd, Bombay, India
	International Oil Storage Operators Perspective •**Mr Gerrit Stofregen**, President, Paktank Asia-Pacific Ltd, HongKong
	Railway's Plans for Transportation of Petroleum Products 1995-2000 •**Mr Shanti Narain**, Advisor (Traffic), Railway Board, India, New Delhi, India
5 30pm	**SUMMARY, CONCLUSIONS AND CLOSE OF CONFERENCE**
Conference Co-Chairman	Session to be chaired by **Dr Fereidun Fesharaki** and **Dr R K Pachauri**

NDAY [redacted]

pm to 6 00pm — Pre Registration at the **Durbar Foyer**

pm to 8 00pm — Opening reception hosted by **Bharat Shell Ltd** (a joint venture between Bharat Petroleum Corp & Shell Overseas Investments B V), at the **Shahjehan**, Taj Palace Inter-Continental

ONDAY [redacted]

m to 8 30am — Registration at the **Durbar Foyer**

WELCOME AND INAUGURATION

m to 8 45am — Conference Co-Chairmen's Welcome
- **Dr Fereidun Fesharaki**, Director Program on Resources, East-West Center, Hawaii USA and
- **Dr R K Pachauri**, Director, Tata Energy Research Institute, New Delhi, India

m to 8 55am — Welcome by
- **Dr V L Kelkar**, Secretary, Ministry of Petroleum and Natural Gas, Government of India

m to 9 20am — INAUGURAL ADDRESS BY
- **Dr Manmohan Singh**, The Honourable Minister of Finance, Government of India

m to 9 25am — Vote of thanks by
- **Mr R K Batra**, Advisor, Corporate Sector Tata Energy Research Institute New Delhi

m to 9 45am — Coffee Break

KEYNOTE ADDRESSES

m to 10 45am — KEYNOTE ADDRESS I
Deregulation How Far and How Fast?
- **Dr V L Kelkar**, Secretary, Ministry of Petroleum and Natural Gas, Government of India

KEYNOTE ADDRESS II
- **Mr David J Law-Smith**, Chairman President & CEO, Caltex Petroleum Corporation Dallas USA

am to 12 00pm — **PANEL ONE INDIA'S ROLE IN THE WORLD OIL MARKETS**

l Chairman
- **Dr Dennis J O' Brien**, Chief Economist, Caltex Petroleum Corporation, Dallas, USA

llists

The International Energy Agency's View of World Oil Markets
- **Mr John P Ferriter** Deputy Executive Director, International Energy Agency, Paris, France

Product Demand Scenarios and Product Demand Forecasts for India
- **Mr D C Lahiri**, Executive Director, Oil Coordination Committee, Government of India, Ministry of Petroleum & Natural Gas, New Delhi, India

The Indian Oil Industry in the Global & Regional Context Challenges Ahead
- **Dr Fereidun Fesharaki**, Director, Program on Resources, East-West Center, Hawaii, USA

pm to 1 30pm — Conference Luncheon I hosted by **Caltex Petroleum Corp** at the **Shahjehan**

m to 2 45pm — **PANEL TWO: OUTLOOK FOR EXPLORATION AND UTILISATION OF OIL AND NATURAL GAS IN INDIA**

l Chairman
- **Mr B C Bora**, Chairman & Managing Director, Oil and Natural Gas Corporation, New Delhi, India

Panellists

Gas Demand in India and Pipeline Transmission Infrastructure 1995-2005
- **Mr K K Kapoor**, Chairman and Managing Director Gas Authority of India Limited New Delhi India

Case Study of the Ravva Development Project
- **Dr John Doran** Managing Director Command Petroleum Ltd, Sydney, Australia

Iran India Pipeline Challenges & Prospects
- **Dr Narsi Ghorban**, Associate Researcher Institute for Political and International Studies Ministry of Foreign Affairs Islamic Republic of Iran

2 45pm to 3 00pm — Coffee Break

3 00pm to 3 45pm — **PANEL THREE DEREGULATION AND PRIVATISATION SOME PERSPECTIVES**

Panel Chairman
- **Mr R K Narang**, Chairman Indian Oil Corporation Ltd, India

Panellists

Malaysia's Perspective
- **Mr Hamzah Bin Bakar** Senior Vice President Petronas, Kuala Lumpur Malaysia

Oil Market Deregulation in Thailand
- **Mr Prasert Bunsumpun** Senior Vice President Downstream Oil Business Marketing Petroleum Authority of Thailand Bangkok

4 00pm to 5 30pm — **PANEL FOUR FINANCING OIL AND GAS PROJECTS IN INDIA**

Panel Chairman
- **Mr R N Malhotra** Chairman Indian Council for Research and International Economic Relations New Delhi India

Reform & Restructuring in the Energy Sector [illegible]
- **Dr Anil K Malhotra** Energy Advisor for Asia The World Bank Washington DC USA

The Role of International Equity Markets in Supplying Capital for the Oil Industry
- **Mr David M Gray** Equity Capital Markets Director HSBC Investment Bank London, UK

Financing of Oil and Gas Projects with Special Reference to Project Finance
- **Mr Anthony M Dols**, Senior Vice President & Senior Relationship Manager Natural Resources ABN Amro Bank N V, Amsterdam Netherlands

Financing Oil and Gas Projects in India
- **Dr Chong Serp Chung**, Senior Project Specialist Asian Development Bank, Manila, Philippines

- **Dr A Bhattacharya**, Economic Advisor Oil and Natural Gas Corporation, New Delhi India

5 30pm — Close of Day One

7 30pm — Dinner hosted by **International Petroleum Exchange of London** at the **Rani Bagh**, Taj Palace Inter Continental

UESDAY [redacted]

8 30am to 10 00 am — **PANEL FIVE OUTLOOK FOR NEW REFINING CAPACITY**

Panel Chairman
- **Mr Prabir Sengupta**, Advisor (Energy), Planning Commission, Government of India

Panellists

Technology Upgradation of Indian Refineries
- **Mr Shiv Narain Mathur**, Director (Production), Hindustan Petroleum Corporation Ltd, Bombay, India

ABOUT IOGC ORGANISERS AND ENDORSHERS

The Conference Connection Inc, through its offices in the United States, Singapore and Australia specialises in organising and managing profile international meetings for the oil and gas industries worldwide Dedicated to providing an independent platform for interaction and discu of the latest business and industry strategies, it strives to combine excellence and professionalism though linkage with inter-governm professional and industry groups worldwide Other events being organised by the group include *Pacific Petroleum Insiders (PPI '95) in Singa and The Fourth Annual Middle East Petroleum and Gas Conference (MPGC '96) in Bahrain*

The **Tata Energy Research Institute** (TERI) was established in 1974 as an autonomous non profit research organisation to address pro associated with the provision of adequate and sustainable energy services for all in an equal and sustainable manner It is based in New Del regional units in Bangalore and Guwahati and staff strength of 275 professionals drawn from a broad range of disciplines TERI's wide rang multi disciplinary activities include Energy Environment Interface, Global Warming and Climate Change, Modelling and Policy Analy Conventional Energy Sources It has a specialised Information Centre which provides publications, software and media support to environment institutions and scientists worldwide In 1990 TERI also established the Tata Energy and Resources Institute in Washington further develop and strengthen linkages with institutions and organisations in North America

The **East-West Center** is an educational and research organisation established in Honolulu for over 30 years Its Program on Resources energy and mineral industries at global and regional levels The projects concentrate on international oil and gas markets and the downstream The East-West Center is recognised as the leading source of analysis, data and strategic advisory services for Latin America, the Middle East an Rim

The **International Association for Energy Economics** (IAEE) is a key professional organisation representing energy executives and around the globe Founded in 1977, it provides a forum for the exchange of ideas, experience and issues in the energy field IAEE has o members in 60 countries, with full affiliates in over 35 of these countries
IAEE has an active programme of publications and conferences which attracts delegates representing influential government corporate and energy decision makers

IOGC'95 WOULD LIKE TO THANK THE FOLLOWING SPONSORS FOR THEIR SUPPORT

Platinum Sponsor

Unocal Corporation

UNOCAL 76

Gold Sponsors

Amoco Corporation

AMOCO

Oman Oil Company Inc

Punj Lloyd

Silver Sponsors

Essar Oil Ltd

ESSAR

Smith New Court PLC

Function Hosts

Bharat Shell Ltd

Caltex Petroleum Corporation

CALTEX

International Petroleum Exchange of London

IPE

Singapore International Monetary Exchange

Oman Oil Company Inc

Media Sponsors

ENERGY COMPASS

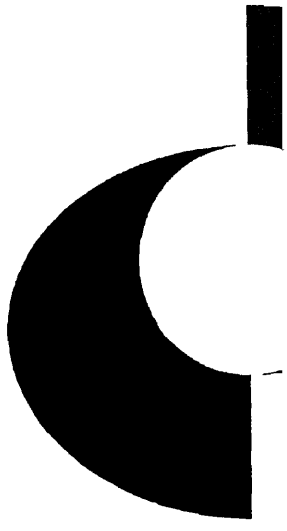
PETROLEUM INTELLIGENCER

PetroMin

Hydrocarbon ASIA

The Conference Connection Inc P O Box 1736 Singapore 911758 Tel + 65 356-0960/61 Fax + 65 356 0962

Tata Energy Research Institute, Darbari Seth Block, India Habitat Center, Lodi Road, New Delhi 110-003 Tel + 9111 462-2246 Fax 9111 + 4



Command
Petroleum

"Working with India"

Operator of the
Ravva Oil and Gas Field
Bay of Bengal

PLEASE NOTE

DUE TO REASONS BEYOND THE CONTROL OF THE ORGANISERS.
IT MAY BE NECESSARY TO MAKE LAST MINUTE ALTERATIONS
TO THE CONTENT AND TIMING OF THE PROGRAMME

The organisers would like to thank the following for their support and assistance during

The First Annual Indian Oil & Gas Conference 1995

SPONSORS

Platinum Sponsor
Unocal Corporation

Gold Sponsors
Amoco Corporation
Oman Oil Company Inc
Punj Lloyd Limited

Silver Sponsors
Essar Group
Smith New Court PLC

Function Hosts
Bharat Shell Ltd
Caltex Petroleum Corporation
International Petroleum Exchange of London
Singapore International Monetary Exchange
Oman Oil Company

MEDIA SPONSORS

Energy Compass
Petroleum Intelligence Weekly
Petromin/HydroCarbon Asia

EXHIBITORS

CBI Eastern Anstalt
KPC Process Consultants
Reuters
Shapoorji Pallonji Group of Companies

SPONSOR PROFILES

Amoco Corporation...

is an integrated energy and petrochemical company with worldwide assets exceeding $29 billion (U S) The company is headquartered in Chicago and has operations in more than 40 countries It is the fourth-largest U S oil company based on assets

The company was the first to refine high-sulfur crude oil and invented the first practical method of cracking crude oil to increase gasoline yields In chemicals, Amoco scientists developed purified terephthalic acid (PTA), today's preferred material for the production of polyester In exploration and production, Amoco was the inventor of the hydraulic fracturing process, is a specialist in enhanced oil recovery, and is an acknowledged world leader in the development of coalbed methane technology

Other important facts about Amoco Corporation and its sectors

Amoco Corporation

- One of the largest publicly traded producers of crude oil and natural gas in the world
- Thirteenth-largest industrial corporation in the United States
- About 43,000 employees worldwide
- In business since 1889

Exploration and Production Sector

- 1994 worldwide net production averaged nearly 670,000 barrels of crude oil and natural gas liquids per day and over 4 billion cubic feet of natural gas per day
- Proven liquid reserves of 2 2 billion barrels proven natural gas reserves of more than 18 trillion cubic feet
- Exploration and production contracts in about 25 countries
- Largest owner and producer of natural gas reserves in the United States and Canada
- About 50 percent of oil and natural gas production revenues are from sources outside the United States
- More than 40 percent of exploration and production s workforce is located outside the United States
- Oil and gas exploration experience in waters as deep as 6,000 feet

Petroleum Products Sector

- Market leader in its 30-state marketing area
- Leading seller of gasoline in the United States
- Serves millions of customers every day through about 9 600 retail outlets
- Five refineries process a total of about 1 million barrels of crude oil daily
- Texas City, Texas, refinery has the world's largest gasoline output at about 270,000 barrels per day
- Unleaded gasoline rated highest in quality by consumers
- First major oil company to introduce compressed natural gas (CNG) at retail locations in the United States
- Owns/operates about 15,000 miles of pipelines for crude oil, refined products, and carbon dioxide

Chemicals Sector

- World's largest producer of purified terephthalic acid (PTA), which is used to make polyester fabric, cassette tapes, microfilm, tire cord, and many types of plastic containers
- World's largest producer of *para*-xylene used in making purified terephthalic acid
- World s largest producer of polybutene, used in cable insulation, fuel additives, and adhesives
- A leading worldwide producer of polypropylene, which goes into synthetic fabrics and fibers for carpet backing food packaging, appliances, and bags for agricultural products
- World's largest supplier of woven polypropylene
- A leading supplier to the unsaturated polyester and paint and coatings markets

Amoco's success is based on integrity, technological innovation, financial strength and the talents of its people Amoco is committed to succeed without compromising its standards and to share the fruits of success with all who work with it

AMOCO

BHARAT SHELL - A COMPANY PROFILE

Bharat Shell Ltd is a joint venture, between Shell Overseas Investments B V (an affiliate of the Royal Dutch Shell Group) and Bharat Petroleum Corporation Ltd It has a mandate to engage in the complete range of petroleum marketing activities in India consistent with the Government of India's policies

Bharat Shell was incorporated in September 1993 The initial focus of its activities was to manufacture and market a range of Shell branded lubricants in India Shell branded lubricants, are now available in select BPCL retail outlets, authorized Service Stations and Work Shops Bharat Shell is also serving major industrial customers including Tata Steel, Telco, SKF, Modi Group, Orissa Cement, Tamil Nadu Petro and NOCIL. Indian OEM'S like Maruti, Hindustan Motors, Caterpillar, Eicher, Escorts, Swaraj Mazda, Greaves Ltd , and Wartsilla India Ltd have all approved Shell Lubricants

Construction work on a state of the art lubricant blending plant has commenced in Bombay The project will be commissioned in 1996

Bharat Shell is also involved in the import and marketing of LPG for industrial, bulk and domestic consumers Bharat Shell's plans are to eventually enter all segments of downstream marketing supported if necessary by investment in infrastructure and manufacturing

The Shell Group in India has recently signed an exploration contract for a block in Rajasthan It is also one of the major suppliers of petroleum products into India



CALTEX PETROLEUM CORPORATION

Caltex Petroleum Corporation is a distinctive community of companies that has become one of the most successful and unique organizations in the history of business Caltex, its affiliates and subsidiaries play an important role in the international petroleum business. T company refines and markets a variety of products in more than 60 countries in the Eastern Hemisphere It sells 1 4 million barrels of crude oil and petroleum products a day Caltex is one of the largest marketers of petroleum products in the Asia-Pacific region and the Middle East

A joint-venture company owned equally by Chevron and Texaco, Caltex supplements its capabilities with the experience and innovations of these two leading oil companies in a concept we call the Power of 3

Among the many Caltex subsidiaries and affiliates, IBP Caltex is an important representative in Asia.

IBP CALTEX

Caltex (India) Ltd. was one of the original Caltex companies, founded in 1937, Caltex operated in India until nationalized in 1977 Caltex has now come back to India as IBP Caltex Limited, a joint venture between the IBP Company Limited and Caltex Oil Corporation formed in 1993

The IBP Co. LTD is one of the four major oil companies in India and has an all-India presence With the infrastructural resources of IBP and the global expertise of Caltex, IBP Caltex Limited (ICL) will have the capability of servicing customers with quality products across the length and breadth of the country

"Caltex" branded lubricants are available at a strong reseller network of over 1,300 IBP fuel stations and through a country-wide distributor network

ICL has plans to enter the LPG market by constructing LPG importation and marketing facilities, and is studying further business opportunities as the petroleum sector is deregulated

International Petroleum Exchange Ltd

International House
1 St Katharine's Way
London E1 9UN
United Kingdom
Telephone: +44 171 481 0643
Fax +44 171 481 8485

Contact: Colette Galea, Marketing Manager

Singapore International Monetary Exchange
1 Raffles Place
#7-00 OUB Centre
Singapore 0104

Tel: +65 535 7382
Fax: +65 535 7282

Contact: Miss Georgi Chong, First Vice President, Energy

The International Petroleum Exchange, (IPE), Europe's only energy exchange, fulfils a unique risk management role for the oil industry and for financial institutions. Trading on average some 60 million barrels a day, it provides contracts trading in Brent crude oil, one of the most important international benchmarks for the pricing of crude oil, as well as gas oil and unleaded gasoline futures. The exchange also provides liquid options contracts trading in Brent crude and gas oil. The IPE is also the first London exchange to enter into a mutual offset agreement with an overseas exchange (SIMEX) This will enable the Brent futures contract to begin trading in the Asia-Pacific market on 9th June 1995.

The Singapore International Monetary Exchange, (SIMEX), is one of the world's leading futures and options exchanges It is the first and only exchange in Asia providing contracts in oil futures, as well as a total of nineteen futures and options in interest rates, stock indices, currencies and precious metal. It co-pioneered the world's first Mutual Offset System under which the highly successful Eurodollar contract now trades In 1994, a record of 11 million Eurodollar contracts were transferred under the Mutual Offset System between the SIMEX and CME.

On Tuesday 14th February, the IPE and SIMEX signed an agreement for Brent crude futures to trade on the Mutual Offset System. It will be London's first mutual offset futures arrangement with an overseas exchange. For SIMEX, it will be the second such trading link This permits users to initiate their transactions on either exchange and close them out, simply and cost effectively, on either exchange at their discretion.

OMAN OIL COMPANY LIMITED

COMPANY FACT SHEET

Under the leadership of His Majesty Sultan Qaboos bin Said, Oman Oil Company Limited was formed in 1992 as a vehicle to make strategic investments in the energy industry outside Oman and to assist in the establishment of a broadly diversified energy-based industry in Oman.

Objectives of Oman Oil Company Limited are:

(1) The development of a diversified energy-based industry in Oman to provide challenging employment opportunities for Omani nationals and to contribute to broadening the Omani economy.

(2) The participation in foreign oil and gas exploration and production activities in order to become a major oil and gas producer outside Oman, with reserves in excess of Oman's domestic petroleum resources.

(3) The development of a significant refining and marketing presence in those geographic areas which have been traditional export markets for Oman in order to secure long term outlets for Oman Export Blend crude oil.

(4) The pursuit of project opportunities world-wide, with emphasis in the geographic areas of the Commonwealth of Independent States, Asia and the Middle East.

Oman Oil's initial efforts have focused on business opportunities, both downstream and upstream outside of Oman. Among its more notable achievements in this arena are:

(1) The agreements with the Government of India which cover

(a) Participation with Bharat Petroleum Corporation Limited, a public sector oil refinery and marketing company, in the construction and operation of a grassroots refinery in Central India with a rated capacity of 120,000 bbls/day, including a lubricating oil plant and a 600 kms overland crude oil pipeline linking the refinery to a crude receiving terminal in the Gulf of Kutch on the West Coast of India.

(b) Participation with Hindustan Petroleum Corporation Limited, another public sector refining and marketing company, in the construction and operation of a grassroots refinery and ancillary facilities on the West Coast of India with a rated capacity of 120,000 bbls/day.

(c) Participation with two major Indian manufacturers of nitrogen fertilizers(Krishak Bharati Cooperative Limited and Rashtriya Chemicals & Fertilizers Ltd.) to design, construct and operate a major nitrogen-based fertilizer complex in Oman. This complex will convert significant portions of Oman's newly discovered gas reserves into valuable exports of ammonia and urea.

(d) The design, construction and operation of an international gas pipeline system from Oman to India, from the Ras al Jifan area on the east coast of Oman to the western coast of India, north of Bombay Scheduled for completion near the end of the decade. the pipeline will supply a major portion of India's growing energy demand at a price that is competitive with less environmentally attractive fuels.

(2) The creation of a Caspian Pipeline Consortium (CPC), owned equally by the founding members, the Republics of Russia, Kazakhstan and the Sultanate of Oman. The CPC will construct and operate the necessary pipeline system to carry some 1 6 million barrels a day of crude oil from the Chevron/Kazakh Tengiz oil field (expected production of 750,000 bbls/day) and other expected crude oil production from planned development in Western Kazakhstan to the Port of Novorossiysk on the Black Sea.

(3) The provision of technical assistance to the Republic of Kazakhstan and the Chevron Company in the resolution of an otherwise long-stalled 6 billion barrel exploration and production agreement in Tengiz in Western Kazakhstan. Despite extremely complex arrangements and unexpected difficulties, this mammoth deal was successfully concluded on 6 April 1993.

(4) The successful negotiation of an exploration and production sharing agreement between the Government of the Republic of Kazakhstan and Oman Oil on 8 April 1993, covering an area of some 16,000 square kilometers (four million acres) in the Pre-Caspian Basin of Western Kazakhstan.

(5) A well repair contract between Oman Oil and Tomskneft Production Association of Western Siberia Oman Oil is assisting in the restoration of non-producing oil wells to help slow declining oil production in Russia. In terms of increasing production in the short-term, workover of existing wells is clearly the fastest and most economic method. Russia has a very large number of idle wells requiring repair, the majority of which are in Western Siberia.

In the area of domestic activities Oman Oil Company Limited, under a management agreement, manages the Oman Refinery Company L.L.C (ORC) which in mid-1994 introduced the first of its "AL MAHA" branded retail stations in Oman. Targeted to capture a major share of the Oman transport fuels market, ORC also supplies fuels to government, aviation and commercial customers

The opportunities for the development of Oman's domestic petroleum resources combined with Oman's demonstrated ability to operate successfully abroad provide the basis for the Sultanate of Oman to enter the next century with a broadly diversified energy-based industry at home and a major presence in the oil industry abroad.

For nearly 34 years, ***Petroleum Intelligence Weekly*** has served as the "bible" of the international oil and gas industry. Company executives, oil traders, Opec ministers and government officials have all benefited from PIW's timely news coverage, extensive data, and insightful analysis. In recent years, PIW has expanded its reporting by adding new titles to create a comprehensive family of publications. Monthlies ***Petroleum Market Intelligence***, ***Global Oil Stocks & Balances***, and ***International Petroleum Finance***, twice-monthly ***World Gas Intelligence*** and the weekly facsimile ***Jet Fuel Intelligence*** supply greater depth and more specialized coverage not possible in PIW itself. Starting in January 1995, PIW became the official printer and distributor of the ***Bulletin of Russian Petroleum & Mining***. A landmark cooperation with Geoinformmark, the Moscow-based publishing arm of the Geology Ministry, the twice-monthly *Bulletin* delivers Russian petroleum licensing and bidding announcements as well as decrees and laws on oil and gas activities.

As PIW expands its coverage, it has responded to the changing needs of the global energy industry in the new age of information transmission. At the forefront of that movement, PIW now delivers its text and data electronically in an easy-to-use software. Subscribers are now receiving ***Petroleum Intelligence Weekly*** and ***World Gas Intelligence*** in an instant and enjoy easy and immediate access to current news, past stories and historical data. Electronic delivery enables PIW to provide more information to subscribers in a faster and more efficient manner.

This expanding network of serial information is complemented by frequent special reports, maps, and databases on all facets of the international oil and gas industry, including a special library dedicated to the CIS oil and gas sectors. PIW frequently sponsors conferences for energy executives, highlighted by an exclusive gathering each April in Washington DC that is co-hosted with its sister firm, *The Petroleum Finance Company, Ltd.*

PIW's business, circulation, and editorial operations are based in New York. PIW covers the world regionally from editorial bureaus in Houston, Washington DC, London, and Singapore. For more information, please call (212) 941-5500 or fax (212) 941-5509.

PUNJ LLOYD

Punj Lloyd is a progressive company in the business of growing Today, it is the acknowledged leader in the country, but Punj Lloyd capability extends well beyond the shores of India

Pipelines are our main thrust area In 1985, we executed our first cross-country pipeline between Bombay and Pune (160km, 14" dia) through hard rock over the mountainous Western Ghats, with gradients up to 45 degrees Since then we have been involved in laying thousands of kilometers of pipeline, up to 48" diameter, 39 5mm thickness and API grade 70, in the Indian Sub-Continent, South East Asia and the Middle East

These include a 557km (22"/14" dia) section of the Kandla-Bhatinda pipeline for the Indian Oil Corporation, completed within a tight schedule of one year, the 210km (16" dia) Balongan-Jakarta pipeline in Indonesia for Pertamina and PT Trihasra Bimanusa Tunggal, and the ongoing 350km (36") section of the Bijaypur-Dadri Pipeline for the Gas Authority of India Notable amongst others are the Jam Yaphour field development in association with Sigma Specialised Engineering and Construction Ltd in Abu Dhabi, onshore portions of the Second Bassein-Hazira pipeline, the HBJ Gas Pipeline, the Grasim pipeline, and the JNPT pipeline for Reliance Industries

Over time we have perfected the expertise to handle all types of pipe, through the most difficult and hostile terrain Across mountains and hard rock, in marshes and swamps, tidal flats, creeks, deserts, congested cities, paddy fields, dense forest even shrimp farms within the country and beyond

To turn engineering dreams into reality, Punj Lloyd has over 2,000 qualified, hard working people who are geared to survive against all odds Helping them achieve this are four jumbo spreads, each with a capacity to lay 2 5km of pipeline per day and handle pipes up to 56" dia Our modern equipment ranges from dozers and graders to trenchers, excavators, heavy duty cranes, side booms, helicopters and mash buggies

Besides laying pipelines, Punj Lloyd is ranked as one of the leading companies in the field of turnkey and specialised construction Our strengths lie in the areas of design, engineering, construction and project management Stringent quality control measures and flexible execution capabilities have also contributed to our performance Amongst the large projects that we have undertaken are the raw water supply system for Chambal Fertilisers, Tank Farms for Reliance Industries and Oil and Natural Gas Corporation, a three year maintenance contract for tanks from KNPC in Kuwait, the entire onshore works for development of Ravva Oil and gas fields on the eastern coast of India including oil storage floating roof tanks of 65Mt dia, and extremely advanced jet engine test bed and repair facility for Indian Airlines at New Delhi

In addition, we have built compressor stations, integrated desalter plants, critical nuclear piping, structural work, captive power plants, cooling water piping, effluent treatment plants all on turnkey basis

Building the future is our aim And confidence, our biggest strength It's a winning combination for us and for our clients

Unocal Corporation

Corporate Profile

Unocal Corporation is a fully integrated, high-technology earth resources company which produces and sells a broad array of essential energy resources, petroleum products, chemical fertilizers, and specialty minerals that help improve the quality of life for people around the world

Founded in California in 1890, Unocal is one of the few U S energy companies with more than a century of experience It is a medium-sized company with worldwide assets and a reputation for low-cost oil and gas production Having just completed a major reorganization, Unocal is positioned for growth in Asia, the Middle East and the Americas

Unocal has worked in Indonesia for over 25 years, having signed the first production sharing contract in 1968 It brought the giant Attaka field into production in record time in 1970 Today, production from all its offshore fields has exceeded 711 million barrels of oil and 1,250 billion cubic feet of natural gas Its Santan liquid extraction plant supplies dry gas to LNG and fertilizer plants

Indonesia is also rich in clean, efficient geothermal resources Unocal is the world's largest developer of geothermal energy and works closely with Pertamina to develop the resource and build and operate nearby electrical power plants Two major projects in Java and Sumatra are underway At Gunung Salak, 110 megawatts of electricity is already under production, with plans calling for Unocal to build and operate three of four new 55MW power plants by mid 1997 On Sumatra, north of Medan, Unocal will supply PLN, the state utility, with up to 1000 megawatts of electricity Other areas are also being considered for geothermal development

In the Philippines, Unocal has two long-running geothermal projects on the island of Luzon Even during the time of severe energy shortage, these plants kept a steady supply of electricity to essential industries

In Thailand, Unocal's offshore natural gas project has spurred that country's exceptional growth of the 1980s and '90s With spending reaching almost US$4 billion, offshore natural gas has supplied 35-40% of Thailand's electricity production since the early 1980s

Also in the region, Unocal holds a major interest in an offshore Myanmar natural gas production and pipeline project

Unocal has oil and gas projects in the U S , including the Gulf of Mexico and Alaska, where it operates one of its two fertilizer plants The company is a partner in the US$7 billion project to extract oil from the Caspian Sea

Training and career development are cornerstones of the company's operating philosophy A huge safety and environmental training center in southern Thailand is an industry showcase for state-of-the-art training techniques and facilities More than 90% of Unocal's international employees are nationals of host countries

OIL & POLITICS

All You Need To Know ...
When You Need To Know It

ENERGY COMPASS

Since first publishing in 1990, *Energy Compass* has been at the leading edge of oil journalism with its unique focus on worldwide political developments and their impact on the oil industry *Energy Compass* meets the time-sensitive needs of today's oil industry, dispatching news reports immediately by fax as soon as major stories develop. Exceptional sourcing, exclusive interviews and forward-looking analysis make *Energy Compass* the most comprehensive and authoritative industry news source available.

OTHER PUBLICATIONS FROM THE OIL DAILY CO

Nefte Compass
Devoted to the oil and gas industry in the former Soviet Union and Eastern Europe, this weekly publication has become the leading source of fast-breaking news and analysis of the forces at work in the region.

The Oil Daily
The leading daily newsletter published specifically for the US petroleum industry for over 40 years. The publication is essential reading not only for domestic companies but for any foreign oil concern sizing up business openings in the world's largest oil market.

Natural Gas Week and *Natural Gas Week International*
This weekly newsletter and its monthly global supplement cover the North American and international natural gas scene, including comprehensive pricing and statistical data, as well as detailed coverage of legislative and regulatory issues, and business developments in all sectors of the gas industry.

For further information, call Elizabeth McLaughlin +44 (171) 584 6444: Energy Compass, Knightsbridge House, 197 Knightsbridge, London SW7 1RZ, UK (fax: +44 (171) 584 9588) or call Suzanna Sanborn +1 (202) 772 0741; The Oil Daily Co., 1401 New York Ave, NW, Suite 500, Washington DC 20005, USA (fax: +1 (202) 662 0739).

SMITH NEW COURT / MERRILL LYNCH

Smith New Court, the leading UK-based international securities business, recently combined with Merrill Lynch to form the largest equity securities organisation in the world Merrill Lynch is a leading underwriter of new equity issues in both the US and world-wide. the combination has produced the world's largest equity market making, distribution and research firm as well The combined firm has the largest equity research team in the world with approximately 370 analysts and has an equity distribution capability serving in excess of 7000 institutional and 6 million private clients world-wide Merrill Lynch is the largest trader of Asian ADR's and among the top traders of Asian common shares

In India the combination of Merrill Lynch and Smith New Court offers investors and issuer clients an unrivalled range of capital raising, advisory, asset management and other investment services Through DSP Financial Consultants, in which Merrill Lynch has acquired a significant shareholding, the firm provides the Indian government and Indian corporations with strategic advisory services and access to the domestic and international capital markets In the secondary markets, Smith New Court has been active for two years in the distribution and trading of Indian securities It has established the leading research capability in the Indian oil and gas sector

Merrill Lynch is one of the world's premier financial management and advisory companies with more than 44,000 employees in over 500 offices in 38 countries Its strategic goal is to achieve leadership in investment banking world-wide Merrill Lynch has been the top global underwriter of debt and equity securities for the past six years. serving as lead underwriter of $137 8 billion in new securities in 1994 Merrill Lynch's total private client assets exceed $643 billion

EXHIBITOR PROFILES



CHICAGO BRIDGE & IRON COMPANY

CORPORATE PROFILE

CHICAGO BRIDGE & IRON COMPANY (CBI) PROVIDES SPECIALTY ENGINEERING, FABRICATION PROJECT MANAGEMENT, CONSTRUCTION AND RELATED SERVICES TO BUILD AND MAINTAIN FACILITIES AND EQUIPMENT FOR PUBLIC AND PRIVATE ORGANIZATIONS ALL OVER THE WORLD

IN INDIA CBI UNDER A MEMORANDUM OF UNDERSTANDING WITH ARTSON ENGINEERING BOMBAY SEEKS CONTRACTS FOR ENGINEERING AND CONSTRUCTION OF PLATE STEEL STRUCTURES, AND REPAIR WORK IN REFINERIES AND PETROCHEMICAL PLANTS WE ALSO PROVIDE BULK STORAGE TANKS ELEVATED WATER TANKS, SILOS AND STACKS ON A TURNKEY BASIS INCLUDING STORAGE FOR LOW TEMPERATURE AND CRYOGENIC PRODUCTS SUCH AS AMMONIA LPG, ETHYLENE AND LNG

Introduction to Reuters

Reuters is about information. Around the clock. gathering it, distributing it using the latest electronic means, and helping our customers analyse and trade. To do these things, Reuters never sleeps. Whether covering wars or filming typhoons, or flashing out vital financial figures ,or maintaining complex share trading systems, we know that in our business every second counts.

It is a culture handed down from our founder, Paul Julius Reuter, with roots in our origins as a news agency an over 143 year old tradition of speed, accuracy and independence. It comes with a commitment to rapid technical innovation and reliable service.

With current technology, the time span of a single wing beat is enough to flash Reuter information around the globe.

Today we use that technology and bulk of our resources to serve Banks, Financial Institutions, Corporations, brokerage houses and other customers in the Treasury, Money, Securities, Commodities and Energy markets world-wide. They can monitor real-time prices and up to the minute news on one of more than 300,000 Reuter Terminals on our network in over 130 countries, analyse the market trends with our price histories and software programs or to trade financial instruments such as a currency, a stock or a crude oil derivative.

Inseperable from these services is the company's other main activity- the supply of news services to the world press and broadcasting organizations.

Inspite of the quick pace of progress, the values of Reuters stay as they were in the 1850s- be fast, be right, and show no bias. These values have not only helped us build a business, they have helped us spread our name all over the world to people to whom knowledge of the facts is essential., and to whom it would matter if we were not there.

Since 1984, Reuters has been a public limited company, Reuters Holdings plc, registered in England. Its share ownership is spread around the world, with significant holdings in the United Kingdom, the United States and West Asia. Reuters independence, integrity and freedom from bias are protected by the Reuters Foundation Share Company whose directors are the 16 members of the Reuter Trust.

***

To Learn more about Reuter Information Services Please contact your local Reuter office:

BOMBAY
Mr. Rajan Rajaratnam, Sales Manager , India
Reuters India (P) Limited
605 , Raheja Chambers
Nariman Point
Bombay 400 021
Telephone: 022 285 2851
Fax : 022 287 0449

NEW DELHI
Mr. Chander Sethi, Sales Executive
Ms. Ashu Jain, Customer Support Executive
Reuters India (P) Limited
1, Kautilya Marg, Chanakyapuri
New Delhi 110 021
Telephone: 011 301 2428, 301 2434
Fax: 011 301 4043

CALCUTTA
Ms. Zarina Bazliel, Sales Executive
Reuters India (P) Limited
Gr Floor, Queens Court
Queens Park, Calcutta 700 019
Telephone: 033 747544
Fax: 033 746547

MADRAS
Mr. Sanjay Balram, Sales Executive
Reuters India (P) Limited
Gr Flr, GKS House
37, College Road
Madras 600 006
Telephone: 044 827 0176
Fax: 825 9883



An invitation to visit Knight-Ridder .....

Knight-Ridder, a Fortune 200 US corporation with global interests in news, databases and on-line information services, is displaying its real-time energy information service, called MoneyCenter, at the Indian Oil and Gas Conference.

MoneyCenter's many features include -

- ✓ *The best, market moving global energy & financial news*
- ✓ *Extensive OPEC & G7 coverage*
- ✓ *24-hour spot crude oil & products' prices*
- ✓ *Energy futures & options quotes*
- ✓ *Platt's Energy Service including Global Alert*
- ✓ *Petroleum Argus assessments & commentaries*
- ✓ *Asian Petroleum Pricing Index (APPI)*
- ✓ *Rim Intelligence*
- ✓ *Energy statistics and official data*
- ✓ *Long term historical data*

All this is backed up with powerful yet user-friendly software, direct satellite delivery to any part of India and superb after sales support.

A live MoneyCenter screen is installed at this conference. Come by at any time to catch up with the markets.

Knight-Ridder Financial / India

907 Arunachal, 19 Barakhamba Road New Delhi - 110 001 Phone-91-(11)-3353355, Fax-91-(11)-3712741
311 Embassy Centre, Nariman Point, Bombay - 400 021 Phone-91-(22)28755409, 28755396, Fax-91-(22)-28756545

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

INDIA : ASIA'S EMERGING OIL GIANT

Chairmen, Ministerial Presentations & Panellists

Monday September 25 1995

CONFERENCE CO-CHAIRMEN

Dr Fereidun Fesharaki	Director, Program on Resources, East-West Center, Hawaii, USA
Dr R.K. Pachauri	Director, Tata Energy Research Institute, New Delhi, India

WELCOME AND INAUGURATION

Welcome Remarks

Dr V L Kelkar	Secretary, Ministry of Petroleum and Natural Gas, Government of India

Inaugural Address

Dr Manmohan Singh	The Honourable Minister of Finance, New Delhi, India

Vote Of Thanks

Mr R K Batra	Advisor, Corporate Sector, Tata Energy Research Institute, New Delhi, India

KEYNOTE ADDRESSES

Dr V L Kelkar	Secretary, Ministry of Petroleum and Natural Gas, Government of India
Mr David J Law-Smith	Chairman, President & CEO, Caltex Petroleum Corp, Dallas, USA

PANEL CHAIRMEN

Dr Dennis J' O Brien	Chief Economist, Caltex Petroleum Corporation, Dallas, USA
Mr.B.C.Bora	Chairman & MD, Oil and Natural Gas Corporation, New Delhi, India
Mr R K Narang	Chairman, Indian Oil Corporation Ltd, India
Mr R.N. Malhotra	Chairman, Indian Council for Research & International Economic Relations, New Delhi, India

The First Annual
Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

Panellists

Monday September 25 1995

PANELLISTS

Mr John P Ferriter	Deputy Executive Director, International Energy Agency, France
Mr. D.C. Lahiri	Executive Director, Oil Coordination Committee, Government of India
Dr Fereidun Fesharaki	Director, Program on Resources, East-West Center, Hawaii, USA
Mr K K Kapoor	Chairman and Managing Director, Gas Authority of India Ltd, New Delhi, India
Dr John Doran	Managing Director, Command Petroleum Ltd Sydney, Australia
Dr Narsi Ghorban	Associate Researcher, Institute for Political and International Studies, Ministry of Foreign Affairs, Islamic Republic of Iran
Mr Shamsul Izhar Abbas	Senior General Manager, Petronas, Kuala Lumpur, Malaysia
Mr Prasert Bunsumpun	Snr VP, Downstream Oil Business Marketing, Petroleum Authority of Thailand, Thailand
Dr Anil K. Malhotra	Energy Advisor for Asia, The World Bank, Washington D C , USA
Mr David M Gray	Equity Capital Markets Director, HSBC Investment Bank, UK
Mr Anthony M Dols	Senior Vice President & Senior Relationship Manager, Natural Resources, ABN Amro Bank N V , Amsterdam, The Netherlands
Dr Chong Serp Chung	Senior Project Specialist, Asian Development Bank, Manila, Philippines
Dr A Bhattacharya	Economic Advisor, Oil and Natural Gas Corporation, New Delhi, India

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

WELCOME & INAUGURATION

DR FEREIDUN FESHARAKI
Director, Program on Resources
East-West Center
Hawaii, USA

DR R K PACHAURI
Director, Tata Energy Research Institute
New Delhi, India

DR V L KELKAR
Secretary, Ministry of Petroleum & Natural Gas
Government of India

DR MANMOHAN SINGH
The Honourable Minister of Finance
Government of India

MR R K BATRA
Advisor, Corporate Sector
Tata Energy Research Institute
New Delhi, India

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter Continental Hotel
New Delhi, India

KEYNOTE ADDRESSES

DR V L KELKAR
Secretary, Ministry of Petroleum & Natural Gas
Government of India

MR DAVID J LAW-SMITH
Chairman, President & CEO
Caltex Petroleum Corporation
Dallas, USA

DE-REGULATION: HOW FAR AND HOW FAST?

DR V L KELKAR
Secretary, Ministry of Petroleum and Natural Gas
Goverment of India

KEYNOTE ADDRESS I

MR DAVID J LAW-SMITH
Chairman, President & CEO
Caltex Petroleum Corporation
USA

KEYNOTE ADDRESS II

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

Mr David J. Law-Smith
Chairman, President and Chief Executive Officer
Caltex Petroleum Corporation
Dallas. USA

David J Law-Smith is a native of the United Kingdom and was born in Kenya

He was educated in Kenya and England before joining a chartered public accounting firm Mr Law-Smith is a Fellow of Chartered Association of Certified Accountants' (U K) and also The Chartered Institute of Secretaries and Administrators (U K), a corporate law body He also attended the Stanford Executive Program in 1993

Mr Law-Smith left public accounting to join the international finance staff of Caltex Petroleum Corporation He has served in a variety of finance and accounting positions in Africa, Australia. Madagascar and Korea, following which he was transferred in 1977 to the headquarters in New York The world-wide corporate office relocated to Dallas in 1982

After a period as the Corporate Treasurer, he was appointed Corporate Comptroller and subsequently a Vice President In 1993, Mr Law-Smith became Senior Vice President and was appointed Chief Financial Officer in March 1994 He was later elected to the Board of Directors With effect from April 1995, Mr Law-Smith assumed the post of Vice chairman

In addition to being a Director of the Corporation Mr Law-Smith serves on the Board of the large Caltex affiliated companies in Australia Bahrain Korea and Japan

David and his wife, Delena have two grown sons who attended high school in Dallas and currently are working in Japan and China

He is Fellow of the Society of International Business Fellow, a member of The Dallas Committee on Foreign relations, has served on the Advisory Council of the Department of Economics and is currently a member of the Executive Board of Dedman College, at Southern Methodist University

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

PANEL I

INDIA'S ROLE IN THE WORLD OIL MARKETS

PANEL CHAIRMAN : **DR DENNIS J O'BRIEN**
Chief Economist
Caltex Petroleum Corporation
Dallas, USA

PANELLISTS : **MR JOHN P FERRITER**
Deputy Executive Director
International Energy Agency
Paris, France

MR D C LAHIRI
Executive Director
Oil Coordination Committee
Ministry of Petroleum & Natural Gas
Government of India

DR FEREIDUN FESHARAKI
Director, Program on Resources
East-West Centre
Hawaii, USA

DR DENNIS J O'BRIEN
Chief Economist
Caltex Petroleum Corporation
USA

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR DENNIS J O' BRIEN
Chief Economist, Caltex Petroleum Corporation
Texas, USA

Chief Economist, Caltex Petroleum Corporation
BA, MA, University of Nebraska, Omaha
Ph D University of Missouri
Formerly Deputy Assistant Secretary for International Oil & Gas, Senior Petroleum Officer, U S Department of Energy, Assistant Manager International Division, U S General Accounting Office, Assistant Associate Professor California State University, Sacramento, University of Missouri, Missouri State University

President, USAEE, 1994-95, Former General Conference Chairman 1989-92 and International Council Member since 1987, IAEE, General Conference Chairman, Washington IAEE Conference 1995 and North American UASEE Conference, Dallas, 1994. President Elect (1996) and President (1997). International association for Energy Economics (IAEE). Program Director. Dallas Committee on Foreign Relations (1986-Present)

Other

- Senior Fellow, ISEM (1986) USAEE (1995)
- Member. Council on Foreign Relations. National Association for Business Economists
- Advisory Board. Cox School of Business SMU
  - American Graduate School of International Management
  - U S National Committee for Pacific Economic Cooperation
  - Energy & Minerals Forum (Asia-Pacific)
- Editorial Board
  - Journal of Energy Finance and Development
  - Journal of Petroleum Finance and Accounting
  - Asia-Pacific Energy Publications, Singapore

THE INTERNATIONAL ENERGY AGENCY'S VIEW OF WORLD OIL MARKETS

MR JOHN P FERRITER
Deputy Executive Director
International Energy Agency
Paris, France

Paper to be distributed separately

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR JOHN P. FERRITER
Deputy Executive Director, International Energy Agency,
Paris, France

Mr John Pierce Ferriter has been the Deputy Executive Director of the International Energy Agency (IEA) in Paris since July 1989 Ambassador Ferriter, 56, came to the 23-nation organisation after twenty-five years as a career diplomat with the United States Department of State His last assignment in the Department was as Deputy Assistant Secretary of State for International Energy, Resources and Food Policy

During his diplomatic career Ambassador Ferriter served in several African countries, and in Paris from 1966 to 1969 with the U S Mission to the Organisation for Economic Co-operation and Development (OECD), and from 1975 to 1978 as Commercial Attache at the U S Embassy He also held a number of positions in Washington with the National Security Council, and the State Department's Economic Bureau

From 1983 to 1985, Ambassador Ferriter served as Deputy Chief of Mission in Kinshasa, Zaire In 1985, he was named Ambassador to Djibouti, where he served until 1987 He also served as a member of the U S delegation to the 41st session of the United Nations General Assembly which met in 1986

Ambassador Ferriter was born in Boston, Massachusetts, on January 26, 1938 He earned academic degrees from Queens College of the University of the City of New York (B A Economics, 1960), Fordham University School of Law (L L B ,1963), and the JFK School of Government, Harvard University (M P A ,1973) He served with the U S Marine Corps Reserve from 1955-1961 He is a member of the New York Bar Association

PRODUCT DEMAND SCENARIOS AND PRODUCT DEMAND FORECASTS FOR INDIA

MR D C LAHIRI
Executive Director
Oil Coordination Committee
Ministry of Petroleum and Natural Gas
Government of India
New Delhi, India

Paper to be distributed separately

THE INDIAN OIL INDUSTRY IN THE GLOBAL & REGIONAL CONTEXT: CHALLENGES AHEAD

DR. FEREIDUN FESHARAKI
Director, Program on Resources
East-West Center
Hawaii, USA

Paper to be distributed separately

The First Annual Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR. FEREIDUN FESHARAKI
Director, Program on Resources, East-West Center
Past-President, International Association for Energy Economics

Dr Fereidun Fesharaki is the Director of the Program on Resources, East-West Center, Honolulu, Hawaii Born in Iran he received his Ph D in Economics from the University of Surrey in England He then completed a Visiting Fellowship at Harvard University's Center for Middle Eastern Studies In the late 1970's, he attended the OPEC Ministerial Conferences in his capacity as Energy Adviser to the Prime Minister of Iran He joined the East-West Center in 1979

His area of specialization is oil and gas market analysis and the downstream petroleum sector, with special emphasis on the Asia-Pacific region, Middle East, Latin America and the United States He has been an adviser to a number of major oil companies, independant companies, trading companies, state-owned oil companies and governments in the Middle East, Pacific Basin and Latin America, as well as the U S government

Dr Fesharaki is the author of more than 70 papers and has authored or edited twenty three books and monographs, the latest of which are *Japan's Long-Term Petroleum Supply Strategy Policy Options for the Government and Industry* (in Japanese, 1993), International Issues in Energy Policy, Development and Economics (Westview Press, 1992), *Fundamentals of Petroleum Trading* (Praeger, 1991), *Developments in the Global Oil Market Implications for the Asia Pacific Region* (in Japanese, 1991), *Energy Market and Policies in ASEAN* (ISEAS, Singapore 1991), *Economic and Political Incentives to Petroleum Exploration: Developments in the Asia Pacific Region* (University Press of America, 1990), *The Oil Market in the 1990s Challenges for the New Era* (Westview Press, 1989), *OPEC and Lower Oil Prices Impacts on Production Capacity, Export Refining, Domestic Demand and Trade Balances* (U S Department of Energy, 1989), *Electricity in Asia and the Pacific Power Station Fuel Demand to 2000* (Economist Intelligence Unit 1989), *Spot Oil, Netbacks and Petroleum Futures* (Economist Intelligence Unit, 1987) and *China's Petroleum Industry in the International Context* (Westview Press, 1986)

Dr Fesharaki is Past President of the International Association for Energy Economics (IAEE), which is the key professional organization representing over 3,000 energy economists in more than 70 countries He serves on the editorial board of the *Energy Policy Journal, Hydrocarbon Asia* and *International Energy and Resources Law and Policy Series* In 1989, Dr Fesharaki was elected a member of the Council on Foreign Relations Since 1991, he has been a member of the Advisory Board of Mitsubishi Oil Company of Japan He is also an Advisory Board member of the Far East Oil Price Index Dr Fesharaki is President of Fesharaki Associates Consulting and Technical Services, Inc , through which he is involved in advising many governments and private companies on issues relating to the petroleum market

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL II

OUTLOOK FOR EXPLORATION & UTLISATION OF OIL & NATURAL GAS IN INDIA

PANEL CHAIRMAN : MR B C BORA
Chairman & Managing Director
Oil & Natural Gas Corporation Ltd
New Delhi, India

PANELLISTS : MR K K KAPOOR
Chairman & Managing Director
Gas Authority of India Ltd
New Delhi, India

DR JOHN DORAN
Managing Director
Command Petroleum Limited
Sydney, Australia

DR NARSI GHORBAN
Senior Oil & Gas Analyst
Institute for Political & International Studies
Ministry of Foreign Affairs
Islamic Republic of Iran

SRINIVASAN
Director (Exploration),
Oil and Natural Gas Corporation,
New Delhi, India

CASE STUDY OF THE RAVVA DEVELOPMENT PROJECT

DR JOHN DORAN
Managing Director
Command Petroleum Limited
Sydney, Australia

INDIAN OIL AND GAS CONFERENCE: INDIA: ASIA'S EMERGING OIL GIANT
SEPTEMBER 24 - 26, 1995

"THE RAVVA DEVELOPMENT PROJECT - A CASE HISTORY IN THE MAKING"

DR. JOHN DORAN
COMMAND PETROLEUM LIMITED, SYDNEY, AUSTRALIA

SLIDE 1- COMMAND PETROLEUM - WORKING WITH INDIA

1. PREAMBLE

SLIDE 2- RAVVA DEVELOPMENT PROJECT - A CASE HISTORY IN THE MAKING

I would like to thank the Organising Committee for inviting me to present this paper today I would also like to acknowledge the assistance which I have received from my colleagues in Command Petroleum Limited (Command), particularly Ms Sally Jones and Ms Kim Foster, who helped with the preparation of this paper

2 RAVVA DEVELOPMENT PROJECT IN CONTEXT

It is now widely recognised that the liberalisation of the Indian economy which has been underway for the last several years is a visionary strategy It promises to provide significant benefits to the people and Government of India although it may be some time before the full extent of these benefits are obvious to the more cynical observers both within and outside India

SLIDE 3 - INDIA'S NEED FOR OIL

The liberalisation of the upstream oil and gas industry in India will generate major benefits by bringing forward and expanding oil exploration and production By cost-effectively increasing Indian oil production, the country will be able to meet more of its rapidly increasing demand for oil, and so reduce imports The benefits are of great significance, given the importance of energy supply to the future economic and social development of the country and its people

- **India's need for oil**

  SLIDE 4 - INDIA'S PRODUCTION VS DEMAND

  In order to meet rising demand, India has an urgent need to accelerate its petroleum production and the rate at which it is adding to its petroleum reserves In these respects India is no different from most countries in the world Indeed, most large oil companies face the same challenge

  The difference with India is that the supply of oil in particular is critical to the future economic and social development of the country and its 900 million-strong and rapidly growing population

Command has undertaken to develop the Ravva Field at a cracking pace The target plateau rate for production of 35,000 BOPD for the Ravva Field is expected to be reached by late 1996

SLIDE 5 - COMMAND'S LICENCES AND APPLICATIONS PENDING IN INDIA

Command has also committed exploration dollars to India The company is currently negotiating the Production Sharing Contract for the KG-OS/6 exploration licence in the Bay of Bengal, and has an application pending for the CB-OS/2 exploration licence in the Bay of Cambay

SLIDE 6 - BEJEWELLED GLOBE

In addition to these activities within India, Command is also cooperating with India's Oil and Natural Gas Corporation on the international stage with the objective of finding new reserves of oil and ultimately producing oil Most recently, Command and ONGC, through international arm ONGC-Videsh Limited (OVL), are joint venturing in the Fejaj Permit, Tunisia.

In addition to its relationship with Command, ONGC Videsh Limited (OVL) has also formed non-exclusive strategic alliances with British Gas and Enserch Corporation As a result of these corporate relationships, OVL has already achieved exploration success in Vietnam and most recently found hydrocarbons with Command in Tunisia These successes are a direct result of India's liberalisation programme

India's desire to broaden its petroleum asset base is not unique Government-owned oil companies all over the world have for some time been seeking to expand their areas of activities away from their home base An example close to home is that Petronas Cangali, the Malaysian Government-owned oil company, applied for the Ravva Contract Area

Technology transfer

SLIDE 7 - TECHNOLOGY TRANSFER

A related benefit which is generated by the liberalisation process may be categorised as 'technology transfer'

The international oil industry is in a state of flux. Far reaching commercial and technical changes are surging through every part of the global oil and gas business Success in the mid-nineties and beyond requires an excellent understanding of the details, direction and implications of these changes A key element in achieving the requisite level of understanding is joint venturing with a diverse group of companies both at home and abroad, which facilitates the transfer of technical information and practical experiences across national and corporate boundaries

SLIDE 8 - NO COMPANY OR GOVERNMENT HAS A MONOPOLY OF WISDOM

India does not need arrogant foreign oil companies that believe they have a monopoly of wisdom and that India would be lucky - and, indeed, should be grateful - if they choose to establish a presence in the country Equally, India's best interests would not be served if the Government-owned oil entities were to adopt an equally arrogant view that there was nothing that they could learn from other oil producers and explorers

- Liberalisation to address the needs of India

  India's need for oil and the associated benefits of technology transfer provide the backdrop for liberalisation against which the Ravva Development Project should be viewed

  In terms of liberalisation, the Ravva Development Project is significant not because of the magnitude of the field or its productive capacity, but because it is one of the first practical examples of the Government's liberalisation policies in action within the oil and gas sector As such, the project represents an interesting case history in the making

SLIDE 9 - COOKING POT

As a case history, the Ravva Development Project is incomplete It is a cake that is yet to be baked Therefore, we must be careful not to read too much into what has happened during the 11 months that has elapsed since the Ravva Production Sharing Contract (PSC) was signed It is still early days, and much remains to be done

Nevertheless, the progress that has been made at Ravva thus far can provide the industry within and beyond India, as well as the Indian Government, with some useful insights During the next 15 minutes I will take you on a journey that has taken Command three years, during which the company translated a business concept in India into reality

3 THE LEAD-UP TO THE RAVVA PSC AWARD

In 1992, as part of the liberalisation process, the Indian Government offered to the world's oil industry a number of exploration areas and producing fields Bids for the areas closed on 31 March 1993

SLIDE 10 - LOCATION OF THE TAPTI AND RAVVA FIELDS

The fields which generated the most interest were the Panna, Mukta and mid and south Tapti Fields off India's west coast and the Ravva Oil and Gas Field in the Bay of Bengal off India's east coast Each area attracted bids from 7 competing consortia

The Indian Government's intention was to accelerate the development of these two fields as the first step towards boosting the country's oil and gas production and reserves through joint ventures with private and publicly listed Indian and foreign companies

The award of the fields to the Enron and Command-led groups were landmark events for all concerned This was the first time in the history of modern India that non-Indian companies had been awarded equity in, and operatorship of, significant Indian fields

SLIDE 11 - RAVVA JOINT VENTURE

Command, with an Indian manufacturing company (Videocon International) and a Japanese trading company (Marubeni) emerged with the winning bid for Ravva in October 1994 An Enron-Reliance Group was awarded the Tapti - Panna - Mukta fields in December 1994

Command's biggest concern when it applied for the Ravva Field was that the Indian Government, driven by an urgent desire to quicken the liberalisation process, might decide to bypass a full assessment process and immediately short list the two or three bidding groups that contained the largest companies in order to fast track the award process This did not happen The Government decided to invite all 7 bidders to present their case in New Delhi

SLIDE 12 - THE GOVERNMENT WAS EVENHANDED

Through that presentation, and also through direct interaction with a wide range of Government representatives over a prolonged period, Command was given ample opportunity to demonstrate its ability The Indian Government made sure that all players were provided with a level playing field Throughout the assessment and negotiations the Government was even handed

SLIDE 13 - THE SELECTION PROCESS WAS TRANSPARENT

The Government also ensured that the selection process was transparent by placing a great deal of emphasis on obtaining consensus within the Government and ONGC circles

SLIDE 14 - BIDDERS

When you are a small Australian oil company up against much larger companies life can be challenging

SLIDE 15 - MOUSE AND DOG

SLIDE 16 - POLE VAULTER

However, the approach taken by the Indian Government provided Command and its co-venturers with as much chance of getting over the bar as any other bidder

By December 1993, after a rigorous bid evaluation process, reports were circling in New Delhi that there were two or three short listed bidders for the Ravva Field By February 1994 the New Delhi grapevine was carrying the message that the Command-Videocon-Marubeni group was the preferred bidder This was confirmed in March 1994 when the Government awarded the Ravva Field to Command and its co-venturers Importantly, the award was conditional upon, and subject to, the negotiation and execution of a PSC On 28 October 1994 the Ravva PSC was executed and the licence was formally awarded to Command and its co-venturers.

To some, the 20 month bid evaluation and contract negotiation process may seem to be rather lengthy However, when this gestation period is compared to the length of time it takes to liberalise sensitive industries in some western countries - including the national airline in Australia - it is seen to be neither unusual nor unreasonable Therefore, it would seem to be a little harsh and/or hypocritical for western observers to criticise the speed of liberalisation in India's oil and gas sector

4. *WHY DID THE COMMAND GROUP WIN?*

Command believes its bid was successful for a number of reasons

SLIDE 17 - WHY DID COMMAND WIN

- **High Indian content.**

  Command's proposed Joint Venture had majority Indian ownership of 65% and the largest Indian content of any of the bidding groups Subsequent to the award of the field to Command and its co-venturers, there were reports that some parts of the industry had not realised that Indian content could be a relevant factor However, it is widely recognised in the international oil industry that it is very important to have a high local content wherever you are operating

- Willingness to spend risk dollars on exploration

  Command's bidding group concurrently applied for a neighbouring exploration permit In this regard it was unique amongst the bidders for Ravva We believed that this, coupled with an aggressive exploration and appraisal programme within the Ravva Contract Area, gave the Government an assurance that Command and its co-venturers were not merely trying to acquire production contracts but were also prepared to commit risk dollars to exploration

- **Very cost competitive**

  Throughout the world, the terms of Production Sharing Contracts are such that Governments - and therefore the population at large - derive little benefit from expensive developments Cost efficiency has become all important. Long gone are the days when foreign companies could apply their corporate largesse to field developments in other countries without reference to how the cost of those developments impact on the host Government's bottom line.

  Command's Australian roots are important to the company psyche, because to survive in Australia's oil industry, companies have to be cost conscious and innovative In the mid 80's this need for innovation drove BHP Petroleum to become a world leader in the concept of floating production technology. In the late 80's it also caused companies like Western Mining Corporation to develop oilfields offshore Western Australia with horizontal wells and a degree of lateral vision not always associated with large corporations Command's application for Ravva was designed to capitalise on its knowledge of cost efficient field development within the Australian oil industry, particularly offshore Western Australia. We believe that the Government of India was quick to recognise the benefits of a cost-conscious approach

5. KEY POINTS OF THE RAVVA PRODUCTION SHARING CONTRACT (PSC)

The terms of the Ravva PSC are equitable to all parties

SLIDE 18 - KEY PSC TERMS

The Indian Government has gone to considerable lengths to devise terms that provide it with an optimum return but which are also attractive to international oil companies

The main features to note are

- The non-Government parties paid a US$12 5 million signature bonus.
- Oil and gas production is sold at world parity price
- Payment is in US dollars
- Royalty and Cess are payable on all petroleum production The royalty rate on crude oil is Rs481/tonne regardless of the value of the oil Cess on crude oil is Rs900/tonne Together these burdens amount to approximately US$6/bbl
- The PSC is designed so that the Government's share over and above its receipt of Cess and Royalty is linked to the project's rate of return This means that the Ravva Field will provide the Government with a proportionately greater share of the benefits of higher oil prices in the future At low oil prices of, say, US$13/bbl the Joint Venture will still be able to maintain commercial production and thereby continue to provide benefit to all parties

- The non-government parties also provide ONGC with a free carry which recognises and reflects the US$55 million which ONGC spent on the Ravva Field prior to licence award
- Royalty on gas is 10% of well head value
- The Joint Venture will also assign directly to the Government a total of 500,000 barrels of additional oil during contract years 3 to 6 inclusive
- The Government will also take a percentage of the profit petroleum which ranges up to 60% depending on the project's rate of return
- The commitment which the joint venturers made to the Government of India is to achieve a plateau rate of 35,000 BOPD within 36 months of the licence being awarded ie by (27 October 1997) At the moment the joint venture's development plan is running ahead of this schedule - but it is still early days
- If the Joint Venture fails to hit the 35,000 BOPD production target within three years of licence award, the non Government parties have committed to spend up to an additional US$12 million which will not be recoverable from cost oil to achieve the target rate
- A very important and integral part of the Ravva Production Sharing Contract is an aggressive exploration and appraisal effort which will be undertaken at a cost in the order of US$30 million with the objective of adding more reserves To date 30 wells have been drilled by ONGC within the Ravva licence area of which 22 have encountered some form of hydrocarbon indications This indicates a superficial "success" rate of 73% for an area with an average well density of 1 well per 2700 acres Within the licensed area there are 8 unappraised structures with hydrocarbon shows and at least 4 prospects and/or leads
- The Government is responsible for transporting the oil

SLIDE 19 - WRESTLERS

In summary, the Ravva PSC is a good example of what tough, but fair minded, negotiations can achieve

6. POST AWARD ACTIVITY - THE FIRST 11 MONTHS

SLIDE 20 - MAIN EVENTS TO DATE

Immediately after signing the Ravva Production Sharing Contract in New Delhi on 28 October 1994, Command established an office in Madras and took on the legal responsibility of Joint Venture Operator

On 28 February 1995 Command took over field operations

In May 1995, one of the most important building blocks in the Development Plan was put in place with the award of the construction contract to Hyundai Heavy Industries (Hyundai) of Korea for a fixed lump sum price of US$113 million, more than 10% below the original budgeted cost for this aspect of the development

A key aspect of the construction contract is that it has been awarded on an EPIC basis This means that the contractor will have responsibility for engineering, procurement, installation and commissioning As many of you would be aware, this is a concept which is increasingly used in other parts of the world, although, to our knowledge it is the first time that it has been used in India There are many advantages not least of which is that there is a single interface between operator and contractor as opposed to the operator being required to deal with a large number of individual sub-contractors

Because the Ravva Development is on a tight schedule, Hyundai has expanded its relationship with a Houston-based engineering firm, Mustang Engineering Inc., in order to move the construction phase of the project along as quickly as possible This is another "first" for Hyundai and the Ravva Development Project So far this concept seems to be working satisfactorily - although it is still early days

In August 1995 another key contract was awarded when the drilling contract was awarded to Hitech Drilling Company (Hitech) This contract is substantial because during the next three years Hitech will drill up to 28 wells in the Ravva licence area. The award of the drilling contract is also notable for the fact that it is reported to be the first time that an Indian drilling contractor has been awarded a contract by an international oil company

A novel approach has also been adopted with regard to the provision of drilling services Individual services have been grouped together for tendering under three "umbrella" contracts Again, this approach is aimed at increasing project efficiency Schlumberger was the successful tenderer in each case and a single contract is being developed to cover all drilling services

Thus, from a standing start in October 1994, Command quickly built up a team in Madras which now consists of 24 employees and 8 contractors while at the field facility at S'Yanam there are a further 50 employees and 75 contractors making up a total workforce of 157, of which only about 8 (5%) are expatriates

7. THE RAVVA OIL AND GAS FIELD - AN OVERVIEW

SLIDE 21 - UMBRELLAS AT RAVVA

The general climate of the region is tropical/monsoonal through June to October The primary rough season is May to November During this period it is not possible for offshore construction to proceed, although drilling can be undertaken year round

Three-dimensional seismic surveys have been shot over the central part of the Ravva licence area, the data from which is currently being reprocessed

SLIDE 22 - MAP OF FIELD

The Ravva-A platform in Block R17 came on stream in March 1993, with production from wells R-17 and R-34 The Ravva-B platform in Block R10 came on stream in February 1994, with production from two dually completed wells, R-10 and R-35

All wells are producing within their capacity and to high wellhead pressures Of particular importance is the fact that flowing wellhead pressures have not continuously declined, but have tended to stabilise close to the original pressure This indicates reasonable short term pressure support, and material balance calculations further indicate that longer term pressure support may also be significant so that compartmentalisation of the reservoirs in Block R10 may not a problem

Cased hole production testing has been carried out by ONGC on most Ravva wells which had significant oil or gas shows Some interesting points to note on the well tests are

- no sand production was noted in any test,
- no water production was noted in any test,
- zones showing on electric logs as being of 'poor quality' produced at over 2,000 BOPD and
- the wells were perforated low density, over-balanced and only over a small proportion of total sand thickness, which may mean that their productivity could have been understated

SLIDE 23 - CROSS SECTION OF BLOCK R10

The reservoir sands have very high permeabilities Well test analyses indicate an average permeability for net pay sands at Ravva in the order of 2 Darcys or more If a zero-damage completion can be achieved, this should result in excellent production The average pay interval is in excess of 20 metres, but wells will probably not be completed throughout the pay section

Flow rates may be restricted by sand integrity The sand is not well consolidated so it is possible that gravel packing could be required, although the wells are yet to produce measurable sand on test

Recent results of production testing existing wells are encouraging Production testing of the Ravva-17 well has confirmed the view that the 2,000-3,000 BOPD/well production rate which Command used as a basis for its original economic analysis of the Ravva Field is not unreasonable

From mid-July to late August 1995, Ravva-17 was subjected to a series of flow tests using varying choke sizes To date, the well has flowed at a stable rate up to 5,000 BOPD on 56/64 inch choke with no significant water production, a stable gas oil ratio of about 380 scf/bbl, no reported sand production, despite the unconsolidated nature of the reservoir, and no indications of gas coning despite the top of the perforations being within 10 metres of a postulated gas cap

To be conservative in initial modelling, a pressure drawdown limit of 100 psi, equivalent to a production rate limit of 3,000 BOPD, has been placed on each producing well In practice Command believes individual wells could produce at an initial rate in excess of 4,000 BOPD without formation damage or loss of reserves

The oil is prone to form wax at temperatures below 30°C although this does not seem to be a problem with no wax formation noted in the pipelines from the platforms to the shore probably because the crude oil still contains gas at that stage Stabilised crude oil has a tendency to form a gel Again, this is not a problem because in the processing train the crude oil is maintained at a high temperature to achieve stabilisation and the system will be continuously flushed with hot crude or heated externally

The export system contains two pipelines so that the oil can be displaced with water from the lines if required If required, chemicals may be added to the oil in the pipelines to depress the wax formation temperature (pour point depression) and inhibit waxing in the pipelines Facilities are provided to inject the chemicals if alternative methods are not successful

SLIDE 24 - RAVVA DEVELOPMENT MAP

The oil flows from each platform through subsea pipelines to onshore processing facilities The crude oil passes through two stages of oil-gas separation and heating which stabilises the crude to pressure suitable for transportation in road tankers

SLIDE 25 - TRUCK LOADING

The oil is stored in two storage tanks from where it is pumped to the road tanker loading gantry

SLIDE 26 - GAS FLARE

At the moment the gas associated with the oil is separated in the stabilisation train and flared but the joint venture is actively trying to gain immediate access to the local gas distribution network on an interim, no profit, basis so as to eliminate flaring When the field is fully developed the flaring will certainly cease and the gas will be sold to the regional grid via the recently completed spur pipeline

At the moment the production capacity of the processing plant is approximately 8,600 barrels of per day

Production is limited by trucking

SLIDE 27 - TRUCK ON ROAD

The Joint Venture is also actively trying to eliminate the need for transporting the oil by trucks through the development of an Alternative Loading System (ALS).

SLIDE 28 - OIL TRUCKED TO DATE

This will be an interim arrangement that would allow production to be maintained without the need for trucking prior to the installation of the offshore loading buoy in 1996

However, at the moment, the oil is transported by truck and then by barge to the Hindustan Petroleum Company's refinery at Vizag

8 THE DEVELOPMENT PROJECT - AN OVERVIEW

SLIDE 29 - DEVELOPMENT PLAN

Five more well head platforms will be installed offshore and a new 40,000 BOPD processing plant will be built onshore The processed product will be transported offshore to a loading buoy from whence it will be loaded into tankers During the construction and installation phase of the project production will continue from the existing facilities When the new facilities are complete the existing processing plant will be shut down and refurbished to act as a standby for the new plant The existing offshore platforms will remain in production although the existing wells will be worked over to improve their productivity

The new plant will include facilities to capture and distribute the gas associated with the oil, plus gas from new gas wells, inject water into the reservoir to maintain reservoir pressure if required and clean up the water separated from the oil prior to disposal

The design provides for the future installation of gas compression facilities to inject gas into the wells to assist with production (ie gas lift) if required

Command has negotiated a contract with the Gas Authority India Limited (GAIL) with regard to the sale of the Ravva gas into the national grid

All the required electrical power will be generated on-site using some of the gas from the field

A new control room will be provided at the plant and this will be the command centre for the platforms processing and unloading facilities The system will be electronic/computer-based with control shutdown and safety systems built in

9. WHAT HAS BEEN ACHIEVED SO FAR?

SLIDE 30 - WHAT HAS BEEN ACHIEVED SO FAR?

Eleven months into the project is too soon to make dogmatic comments as to the results achieved thus far - because it is still very early days!

Nevertheless, the project's tight schedule does allow us to itemise just some of the events of the last 11 months

- More or less seamless transfer of operatorship from ONGC to Command
- Establishment of a basically harmonious Joint Venture
- Establishment of a 157 - strong work force in Madras and at the onshore facilities at S'Yanam, 95% of which are Indian nationals
- Compilation and distribution of major EPIC Construction Contract document call for followed by rigorous and exhaustive selection process within six months of award
- Re-examination of technical data base resulting in an approximate 30% increase in recoverable oil and oil equivalent reserves This will extend the plateau production period from 5 years to 8 years.

SLIDE 31 - PRODUCTION FORECAST

- 3D seismic re-processing initiated
- Production testing of Ravva-17 confirms excellent productivity and little/no gas, water or sand production
- Maintenance of production at levels which are dictated by trucking limitations
- Submitted a non-profit proposal which would allow gas flaring to cease in the very near future well ahead of full production when flaring will, in any event, cease
- Compilation and distribution of Drilling Contract document, call for tenders, evaluation of bids and eventual award of contract to Indian drilling company, Hitech
- Placing of all major drilling services via a Combined Drilling Service Contract

10. LESSONS LEARNT - CHALLENGES FACED

SLIDE 32 - LESSONS LEARNT - CHALLENGES FACED

Inevitably, the learning curve has been steep There have been numerous challenges to face but - so far - none that could not be overcome Again, with the caveat that it is still early days, these are some of the main lessons which Command has learnt and the more interesting challenges which have been faced

SLIDE 33 - PRECEDENTS - TOO FEW AND TOO MANY

- **Too few precedents**

The Ravva Development Project is without precedence in modern India Therefore, after the licence award there was a need to establish a lot of procedures for the first time These varied from working with ONGC in that company's first experience as a non-operator in India to working with the Government's Oil Co-ordination Committee and refineries in order to establish a mechanism for payment in US dollars At various times these challenges resulted in situations which could have become frustrating but which, as far as Command is concerned, never probed the boundaries of our patience within the overall context of the project All the issues which could have caused frustrations have been understandable and, probably, predictable particularly when it is considered that the project is at the cutting edge of the liberalisation process in India These first-time challenges have been met with a constructive attitude by all relevant parties which is why they have been largely resolved

- **Too many precedents**

Ironically, other challenges arose from the fact that there are lots of precedents with regard to certain aspects of the oil and gas industry as it has been developed in India For example:

SLIDE 34 - THE "L-1" CONCEPT

There is a strong precedent and preoccupation with selecting the lowest price bidder The "L-1" concept is not uniquely Indian In fact, it is common practice with many Government agencies in the western world Whether you are involved in a Government-owned business in Sydney or dealing with a Government owned entity in India, one of the basic problems which may arise with the "L-1" system is that if it is strictly enforced it is difficult to make allowances for quality differentials Theoretically, this should not be a major problem because the technical selection procedure should ensure that only technically competent contractors make it to the final bid evaluation stage The real problem is that within that group of technically competent contractors there may still be qualitative differentials which could justify awarding the contract to a party other than the lowest bidder if the gap between the lowest bid and that party's bid was considered to be insignificant in view of the extra quality that would be accessed

In order to take this situation into account, the Ravva PSC contains a clause that specifically states that the Joint Venture is not bound to accept the lowest bidder However, with a precedence as well established as "L-1", it will take some time before this aspect of the Ravva PSC is put into full effect

It is also a well established precedent in some parts of the industry to seek at least three quotes before purchasing equipment There are many instances when it is very logical to apply this precedent However, when the precedent requires three bids to be sought for the purchase of a R/s50,000 item, the strict application of this precedent does not increase the efficiency of the purchasing process

- **Rapport with your co-venturers is essential**

  SLIDE 35 - GOODWILL IS THE LUBRICANT

  No matter how hard co-venturers work to ensure that a Production Sharing Contract and Joint Venture Operating Agreement are structured in an optimum manner at the end of the day the lubricant that makes a joint venture work is mutual respect between co-venturers Without this quality, a joint venture will flounder no matter how well the documents upon which it is based are drafted Although obviously, with a group as diverse as the Ravva Joint Venturer, there are inevitably many shades of opinion whatever progress has been made during the last ten months can be attributed to the mutual respect that exists within the joint venture on both an individual and corporate level

  Fortunately, there has been remarkable like-mindedness on many of the key issues so that in a number of significant instances unanimity has been achieved without compromise

- **Contracts are fiercely contested**

  Intensity of competition for contracts has been more than most western companies would have anticipated, although, since the award of the Ravva licence itself was hotly contested, the level of competition should probably not have come as any surprise

- **There is a logic for everything**

  Certain events occur which may create a degree of puzzlement in orthodox western minds However, we are beginning to learn that everything happens for a reason although it may take a while before the logic behind a particular event is fully appreciated When that logic becomes apparent, it often transpires that given the same data set and logical framework we would have reacted in exactly the same manner Of course, this is bad news for western companies who want to immediately adopt a corporate position based on a face value reading of the situation It is good news for companies that are prepared to take time to try to identify the logic behind particular events prior to making their minds up about a particular point

- **Miscellaneous lessons**

  These are some of the other lessons that Command is learning as it seeks to put its catch cry "working with India" into action

  - Preconceived ideas are best left at the airport in the country of origin
  - As in every other part of the world, common corporate courtesy goes a long way
  - Networking is alive and well - just like everywhere else in the world
  - Not every aspect of bureaucracy is bad Bureaucracy moving in a positive direction can be beneficial
  - Things do generally get done, although, it often takes more time than many western companies would expect
  - A good Indian partner is absolutely essential

- The joint venture route has many advantages, particularly when the Indian content is above 50%

- It also helps if you like the people you are dealing with, we do and that makes an enormous difference

- Performance is the key to further opportunities

- There will always be heartstopping moments Most, hopefully all, are capable of resolution without any long lasting angst If a resource asset is significant enough to be worth acquiring and developing, a degree of pain must be expected

- It would be unwise to generalise and draw superficial cross-sector comparisons Every project is an individual case

- In some cases there is a well developed culture of labyrinths Perhaps this is the reason why the Government focuses so much attention on the need for transparency and consensus All over the world there is a fine line between broad based consensus and inaction This is the line along which modern India is walking, so far successfully

- The western business community's perception of India is fickle Several years ago India was regarded most unfavourably

SLIDE 36 - GORILLA

- then, more recently, it threatened to become the "flavour of the month" in the eyes of many western companies In all probability both extreme views are wrong

SLIDE 37 - DOBERMAN

Perhaps the better attitude is a more balanced attitude There are certainly wonderful opportunities but a degree of sensible constraint and discipline is probably required if the opportunities are to be accessed by western companies for the benefit of the people and Government of India as well as those companies

11. CONCLUSION - INDIA'S NEEDS ARE BEING ADDRESSED

SLIDE 38 - INDIA'S NEEDS ARE BEING ADDRESSED

Out of a country of 900 million people it would be remarkable if everyone shared exactly the same view about everything Therefore, it is both predictable and understandable that the concept of liberalisation has been embraced with more enthusiasm by some than by others This is a situation that is no different to that which occurs in any country whenever similar far reaching economic changes are set in motion

That said, it is clear that the opening up of oil and gas opportunities to outside companies has the potential to deliver tangible benefits to India These benefits are far reaching, but in their most narrow form they represent a faster and more efficient development of India's petroleum resources, both discovered and undiscovered

Finally, perhaps we can take some encouragement from Command's own progression during the last eleven months

SLIDE 39 - TRAUMA AND EMERGENCY CENTRE

Our first office was a temporary office in Madras opposite a trauma and emergency centre which negative and cynical observers would suggest was quite appropriate

SLIDE 40 - CAFETERIA KANGAROO

Within a month, Command expects to move into its new permanent office adjacent to the Kangaroo Cafe

Command has grown to respect the Indian view of auspicious and inauspicious days and occasions and, therefore, to us it is most auspicious that in the 11 months since signing the Ravva Production Sharing Contract, the company has moved from facing a trauma and emergency centre to being next to the Kangaroo Cafe

Command Petroleum

"Working with India"

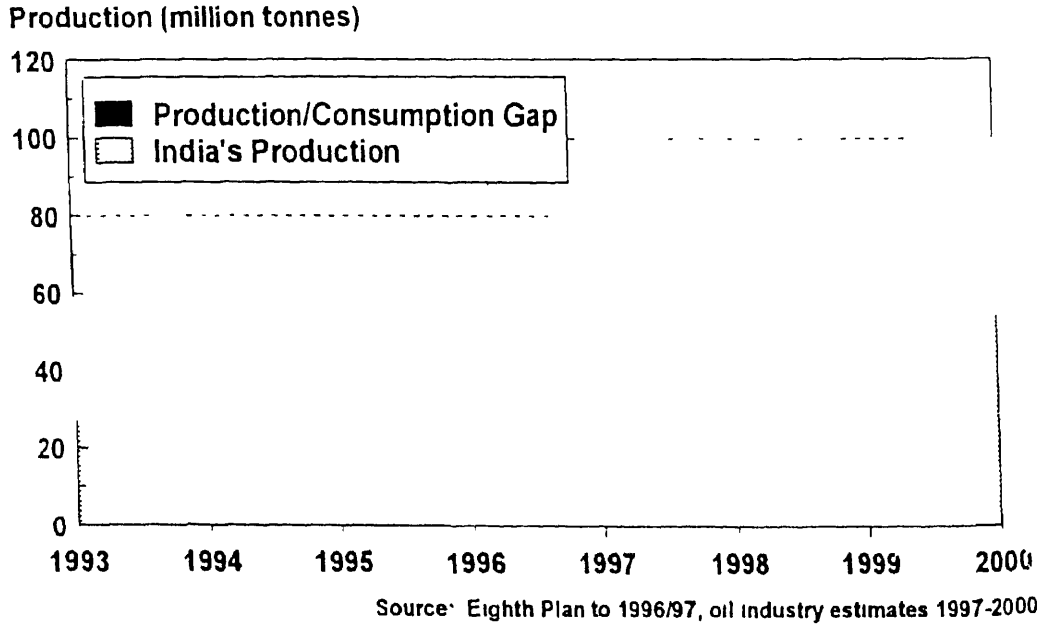
Command Petroleum

Ravva Development Project

A Case History in the Making

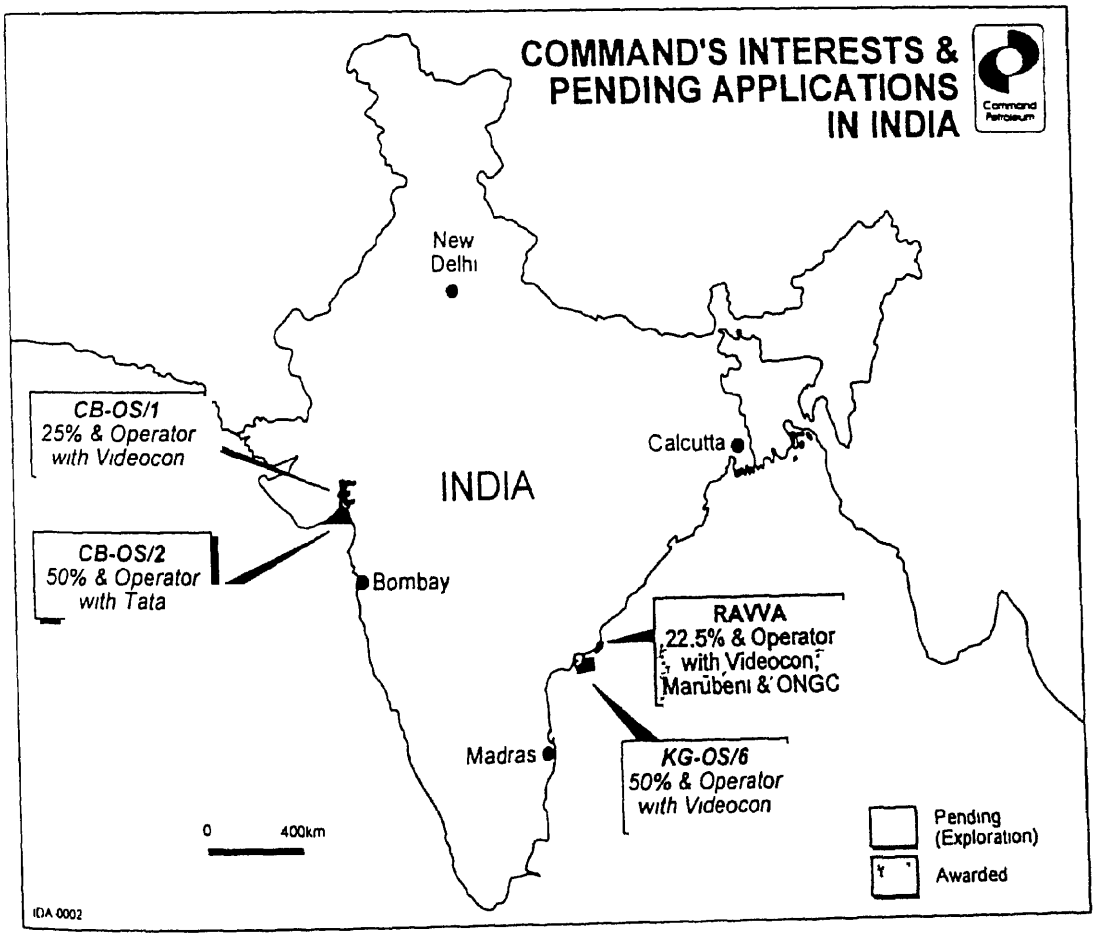
India needs oil

India's Oil Production/Consumption Gap



Source: Eighth Plan to 1996/97, oil industry estimates 1997-2000

Command has committed exploration dollars to India

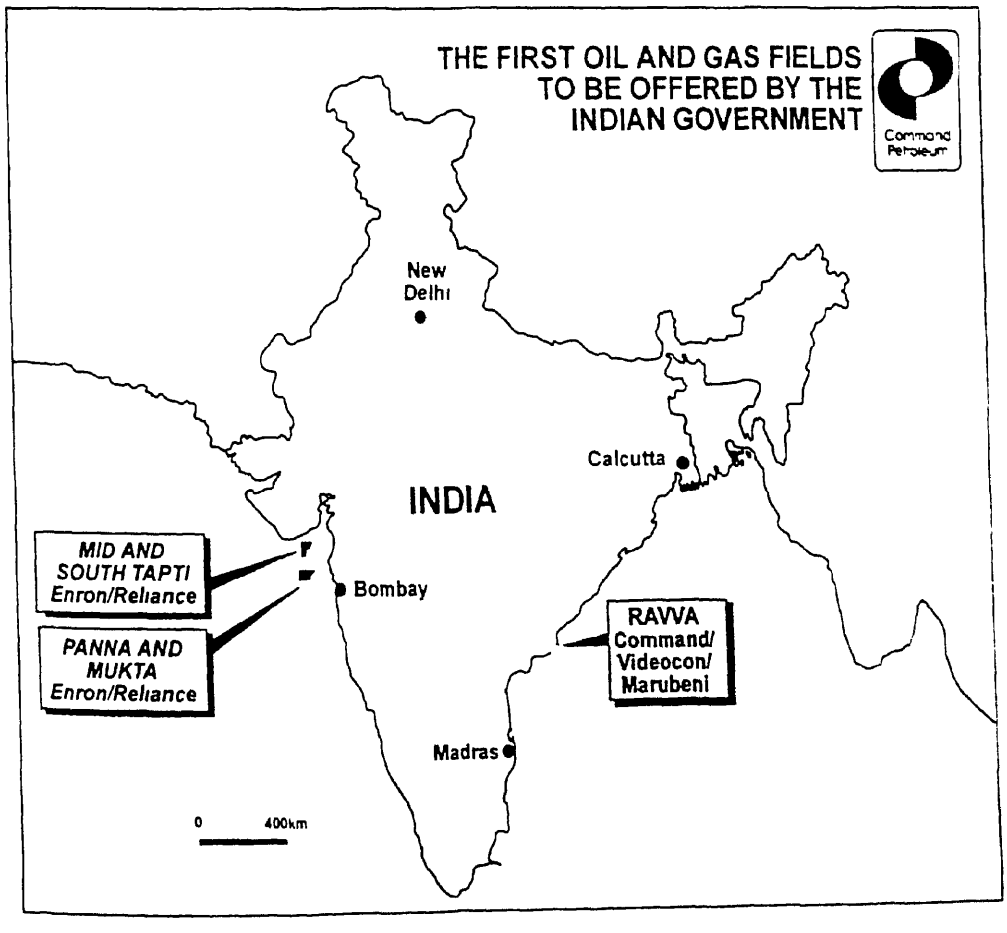


Technology transfer

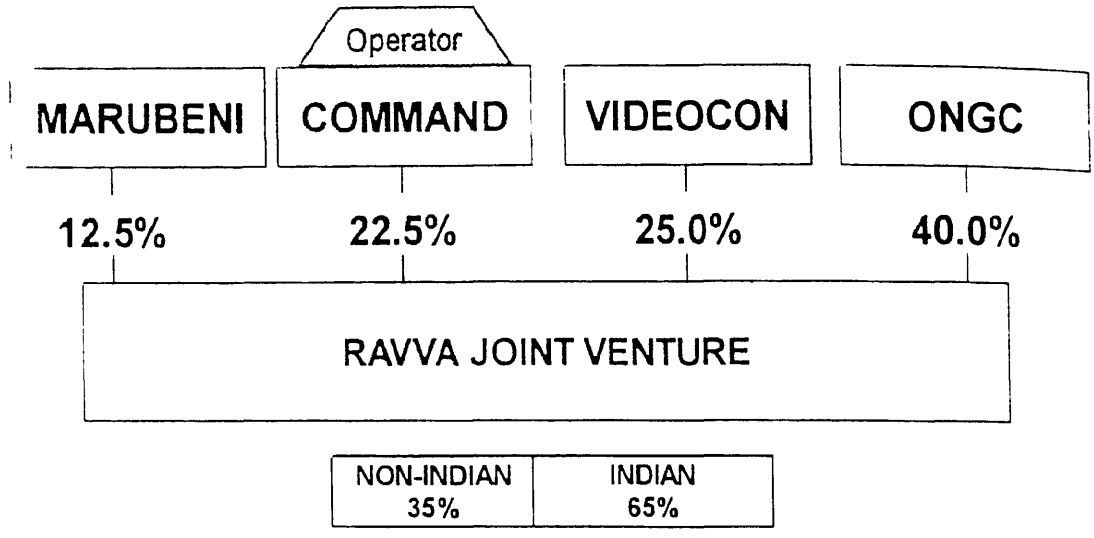


No company or government has a monopoly of wisdom

Liberalisation addresses India's needs



Ravva Joint Venture



The Government was even handed

The selection process was transparent

Ravva Competition

Bidding groups led by:

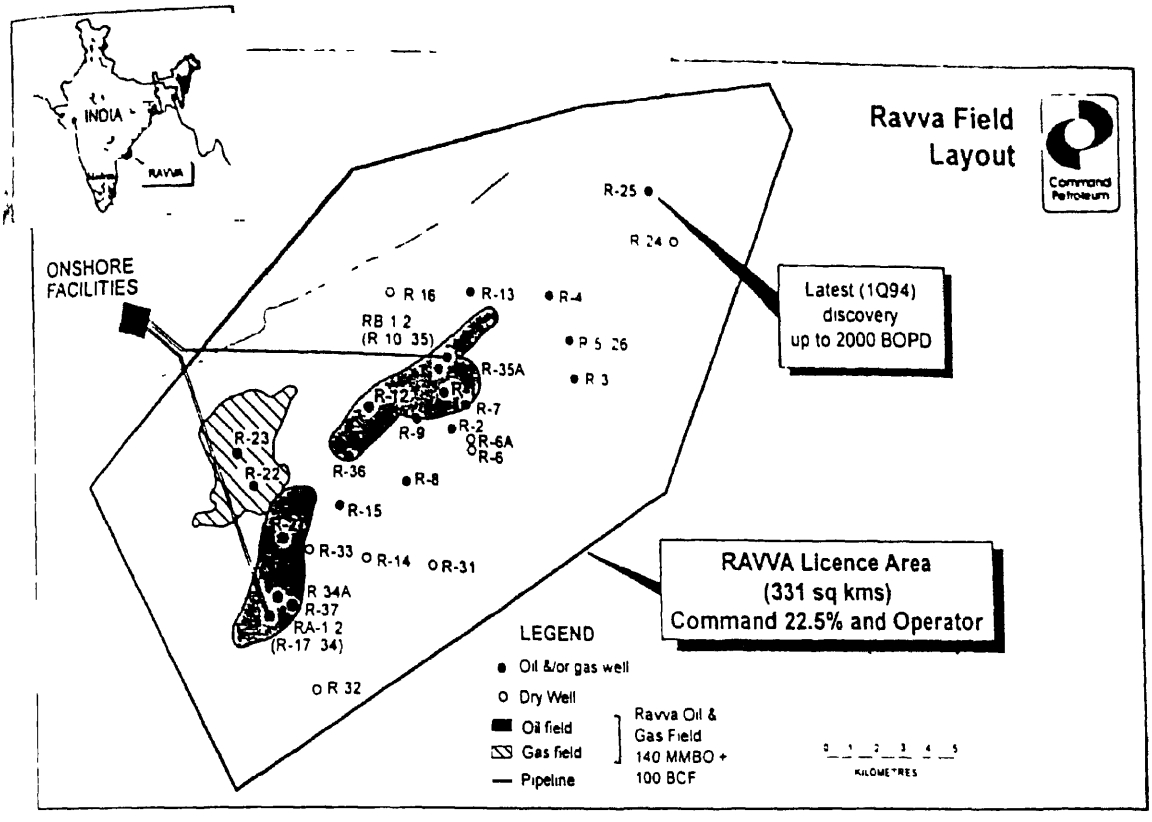
- Occidental (US)
- Hyundai (Korea)
- Petronas (Malaysian Government Oil Co.)
- I.P.C. (Canada)
- Vaalco (US)
- Walter International (US)

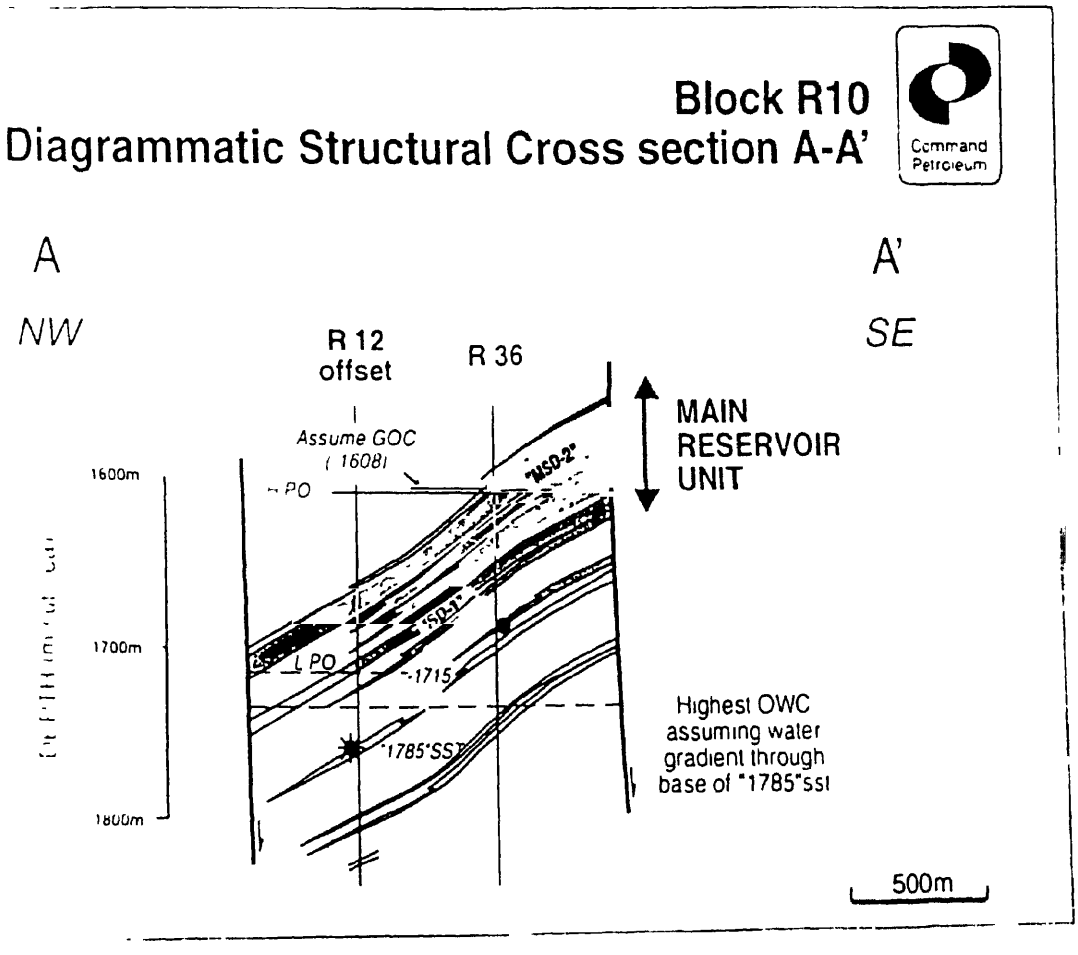
Why did the Command Group win?

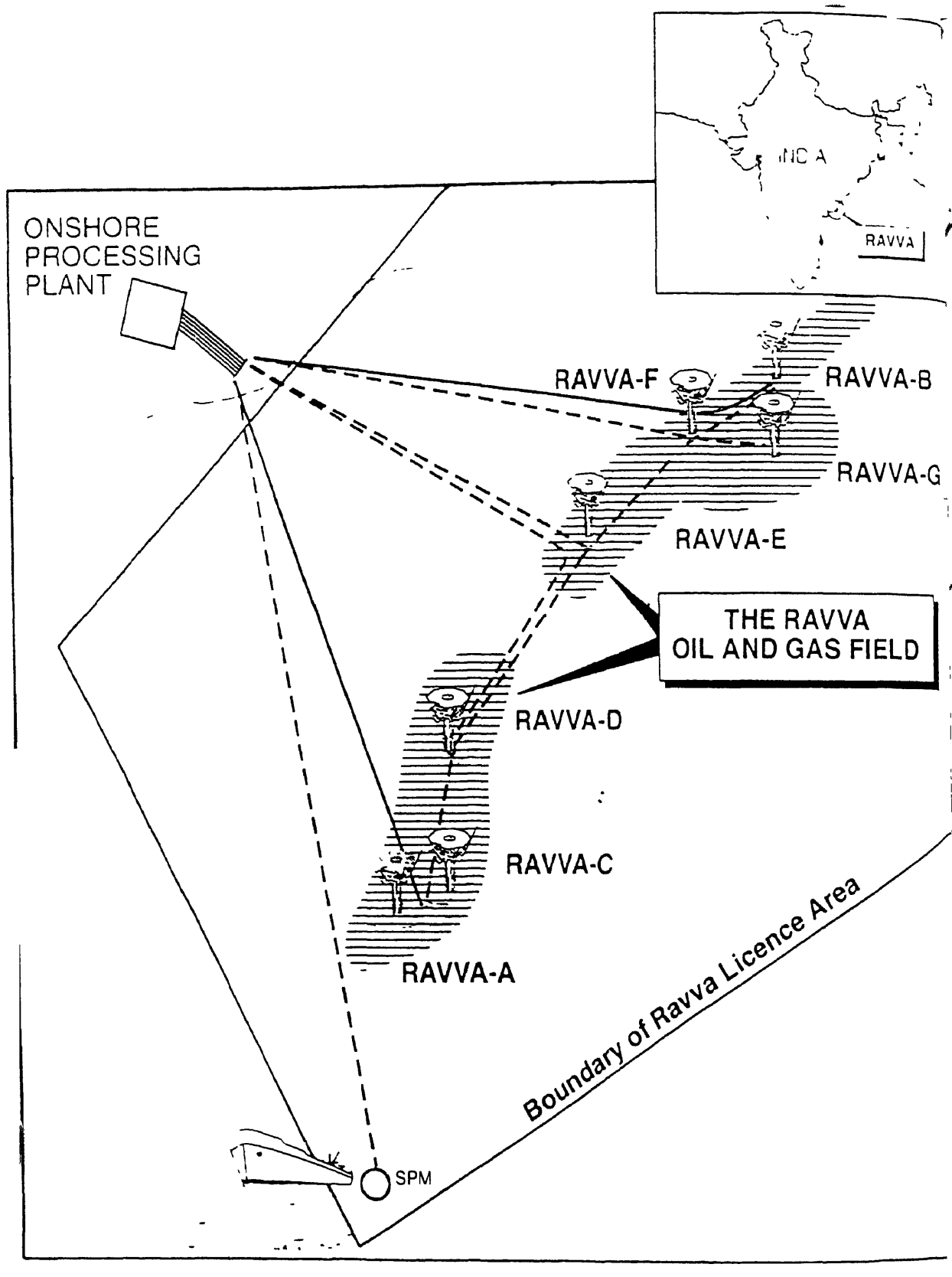
- largest Indian content (65%)
- low capital cost
- technical bid based on 'done-it-before' attitude
- competitive financial package
- willingness to pursue exploration
- responsiveness to host nation sensitivities
- smart, decisive and well-respected Indian partner

Key PSC Terms

- world parity pricing
- US$ payment
- no foreign exchange restrictions
- economic stability provision
- UNCITRAL arbitration in Kuala Lumpur
- approved Development Plan
- no customs duties or re-export requirements
- reasonable environmental protection
- financier friendly


Ravva Field
Layout
Command Petroleum
INDIA
RAVVA
ONSHORE
FACILITIES
R-25
R 24
Latest (1Q94)
discovery
up to 2000 BOPD
R 16
R-13
R-4
RB 1 2
(R 10 35)
P 5 26
R-35A
R 3
R-12
R-7
R-9
R-2
R-6A
R-6
R-23
R-22
R-36
R-8
R-15
R-33
R-14
R-31
R 34A
R-37
RA-1 2
(R-17 34)
R 32
RAVVA Licence Area
(331 sq kms)
Command 22.5% and Operator
LEGEND
Oil &/or gas well
Dry Well
Oil field
Gas field
Pipeline
Ravva Oil &
Gas Field
140 MMBO +
100 BCF
KILOMETRES


Block R10
Diagrammatic Structural Cross section A-A'
Command Petroleum
A
A'
NW
SE
R 12
offset
R 36
Assume GOC
(1608)
PO
"MSD-2"
MAIN
RESERVOIR
UNIT
1600m
1700m
1800m
"SD-1"
PO
-1715
"1785"SST
Highest OWC
assuming water
gradient through
base of "1785"sst
500m



Existing pipeline

Proposed pipeline

Existing production platforms
Ravva A & Ravva B

Proposed production platforms
Ravva C-G

0 1 2 3 4 5

KILOMETRES

17/08/95

RAV 0085

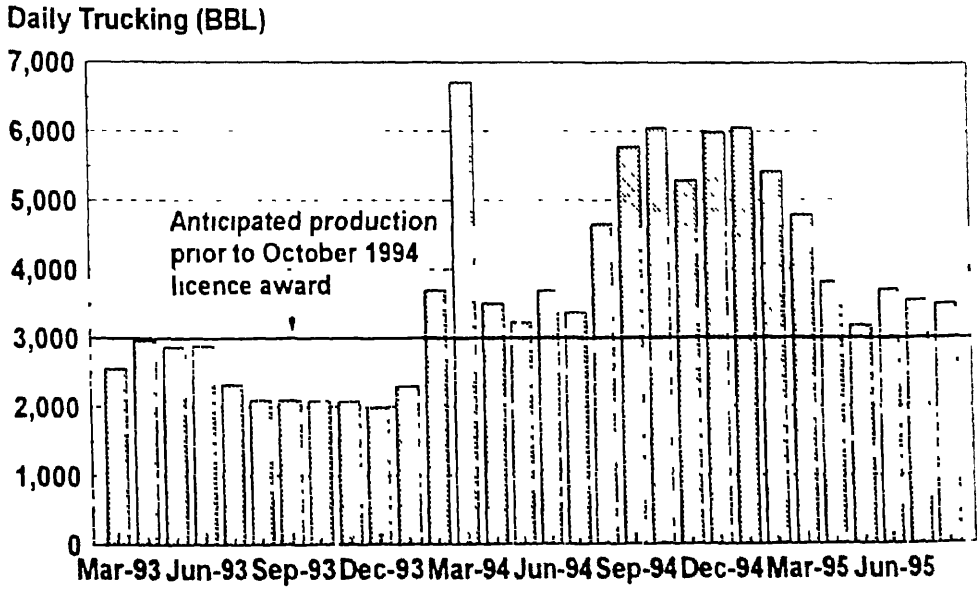
Proposed Ravva Field Development

Showing main production lines & export lines

Main events to date

- PSC signed 28 October 1994
- Command took over field operations 28 Feb 1995
- Construction contract awarded May 1995
- Drilling contract awarded August 1995

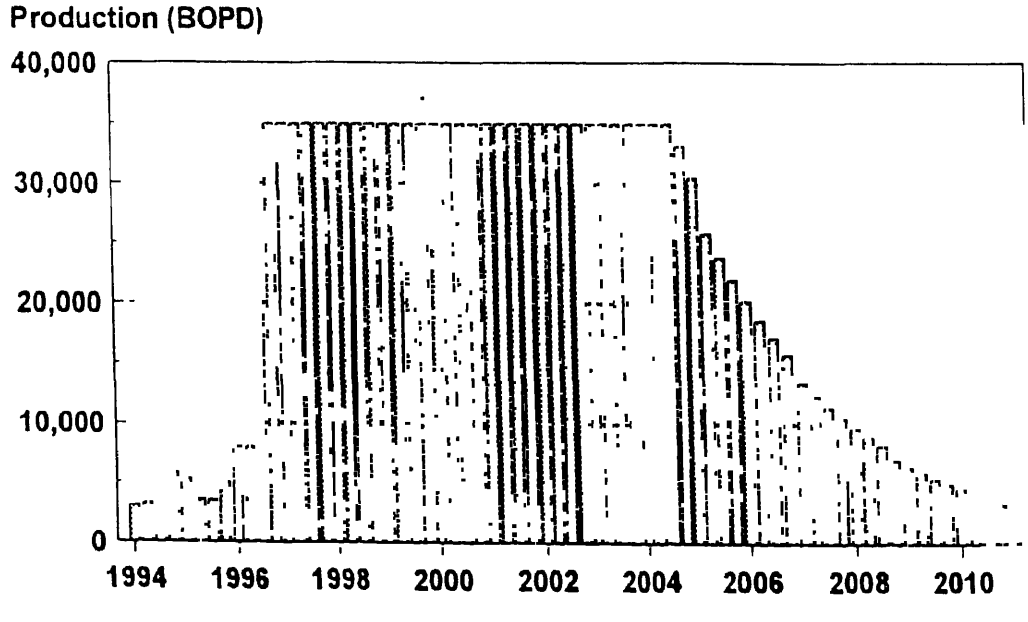
Oil trucked from the Ravva Field



Ravva Development Plan -
Platform facilities to be installed

4 oil platforms and 1 gas platform
Oil & gas flowline to shore
Gas production line to shore
Water injection line from shore
Tanker loading line
Single point mooring
New processing capacity for - 40,000 BOPD
- 50,000 MMSCFD
Upgraded oil storage facilities to - 750,000 bbl
Auxiliary control & maintenance facilities

Forecast Ravva Field Production





Lessons Learnt,

Challenges Faced



Precedents -

too few and too many

Goodwill - the lubricant enabling a joint venture to function efficiently

India's needs are being addressed

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR JOHN DORAN
Managing Director, Command Petroleum Ltd.
Sydney, Australia

Dr John Doran is Managing Director of Command Petroleum Limited, a Sydney-based oil exploration and production company listed on the Australia Stock Exchange

Command has a broad-based portfolio which includes production in the Timor Sea offshore Australia, the Bay of Bengal, offshore India, and in the Ural region of European Russia Command also has interests in exploration permits in Yemen, Australia, Papua New Guinea and Mongolia

Currently, Command's major project is the development of the Ravva Oil and Gas Field, offshore India, in which the company has a 22 5 percent interest The field was awarded to Command and its co-venturers in late 1994, following a competitive bidding process As a result, Command became the first private company in the history of modern India to acquire equity in, and operatorship of, a signficant Indian oil field

During the 1970's, Dr Doran worked for several large companies, in a variety of countries including Noranda Exploration in Ireland, the Conoco-Marathon-Amarada Hess consortium in Libya, the BP Shell-led consortium of Western oil companies in Iran, and Conoco in Norway

Since late 1980 Dr Doran has been based in Sydney-initially as Exploration Manager for an Australian independent, then as Vice-President, Exploration (Australia) for the US independent Nomeco Oil and Gas and, since 1987, as Managing Director of Command Petroleum In these capacities, he has initiated and managed the rapid expansion of these companies within the Asia-Pacific region, and has thereby been involved with a number of significant commercial oil discoveries and acquisitions

By training, Dr Doran is a geologist, with a B Sc (Hons) in Geology from Leicester University (UK) an M Sc from Sheffield University (UK), and a Ph D from Trinity College, Dublin

IRAN-INDIA PIPELINE: CHALLENGES & PROSPECTS

DR NARSI GHORBAN
Senior Oil & Gas Analyst
Institue for Political & International Studies
Ministry of Foreign Affairs
Islamic Republic of Iran

Paper to be distributed separately

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR. NARSI GHORBAN
Senior Oil & Gas Analyst,
Institute for Political and International Studies,
Ministry of Foreign Affairs,
Islamic Republic of Iran

Narsi Ghorban has been a Senior Oil & Gas Analyst at the Institute for Political & International Studies at the Ministry of Foreign Affairs of Iran since 1992

From 1980 to 1991, he served as consultant to a number of organisations on studies relating to international crude oil markets, as well as on specific country studies He was also consultant to the Long Term Strategy Committee of the Organization of Petroleum Exporting Countries (OPEC) from 1978 to 1979

Dr Ghorban is the author of a number of published papers, including *Oil Production, Revenues and Economic Development* (The Economist Intelligence Unit, QER Special No 18, 1994), *Economic Development of the Middle East Oil Exporting States* (The Economist Intelligence Unit Special Report 54, 1978) *Oil and Gas An Outlook for Future Cooperation among the Persian Gulf States* (The Iranian Journal of International Affairs IPIS Vol V, No 3 & 4, Fall Winter 1993/94) and *Political Developments in the Persian Gulf and their Impact on the International Oil Markets* (Iran Focus, July August Vol 6 No 6 7)

Dr Ghorban is an M Phil from Brunel University in the United Kingdom, and a Ph D from the University of London

He is a Fellow of the Institute of Petroleum, a Member of the Royal Institute of International Affairs, and a Member of the International Institute of Strategic Studies

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL III

DE-REGULATION AND PRIVATISATION IN ASIA: SOME PERSPECTIVES

PANEL CHAIRMAN : **MR R K NARANG**
Chairman & Managing Director
Indian Oil Corporation Ltd
India

PANELLISTS : **MR HAMZAH BIN BAKAR**
Senior Vice President
Petronas
K.L., Malaysia

MR PRASERT BUNSUMPUM
Senior Vice-President
Downstream Oil Business Marketing
Petroleum Authority of Thailand
Bangkok, Thailand

R K NARANG
Chairman and Managing Director,
Indian Oil Corporation Ltd.,
India

MALAYSIA'S PERSPECTIVE

SHAMSUL AZHAR ABBAS
Senior General Manager,
Corporate Planning & Business Development,
Petronas,
Kuala Lampur, Malaysia

OIL MARKET DEREGULATION IN THAILAND

MR PRASERT BUNSUMPUM
Senior Vice-President
Downstream Oil Business Marketing
Petroleum Authority of Thailand
Bangkok, Thailand

Oil Market Deregulation in Thailand

Outlines of this presentation

- Summary
- Oil market situation in Thailand before deregulation (before May 1991)
  - Price structure
  - Marketing margin
  - Number of oil companies and service stations
  - Market share
- Reasons Thailand deregulated its oil market
- Steps towards oil market deregulation in Thailand
- Oil market situation in Thailand after deregulation (after August 1991)
  - Price structure
  - Marketing margin
  - Number of oil companies and service stations
  - Market share
- PTT's role as a state enterprise in deregulation scheme
- Result of oil market deregulation in Thailand
  - Key of success
  - Benefit for consumers
  - Benefit for oil companies
- Government's role after deregulation
- Conclusion

- Summary

Being independent from western economies, Asia-Pacific countries have experienced their new era of success. As the result of this eastern economic growth, oil shall remain the main source of its energy demand. Petroleum sectors in these countries, though closely regulated for the time being, cannot avoid the global trend on the wake of market liberalization and open for private competition sooner or later.

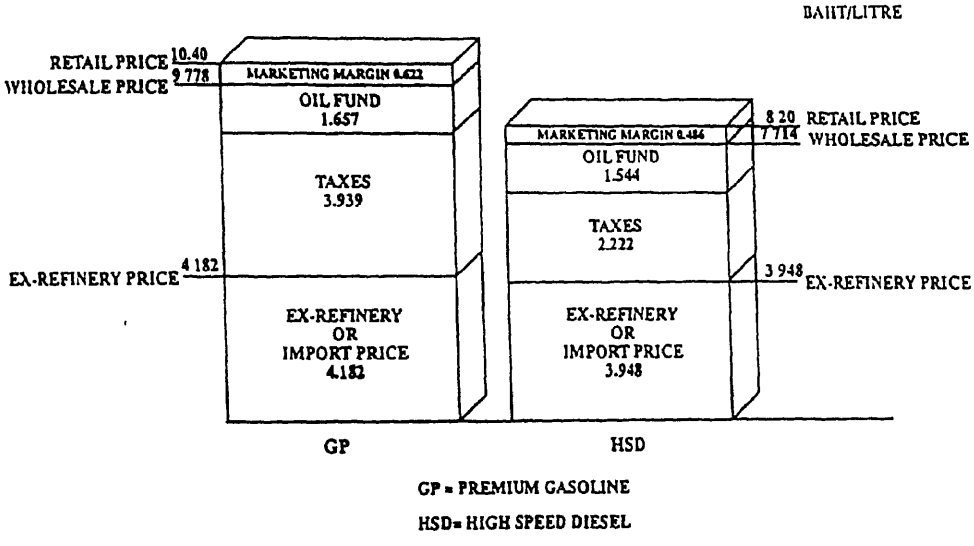
Realizing these facts, Thailand had planned to deregulate its oil sector and set the target in 1991. Controls were relaxed in order to allow the energy market to grow with minimum state inteference. Owing to the government's strong determination, good planning and well implementation, Thailand's attempts at deregulation are finally bearing fruit Having tasted success, Thailand is already sharing experience with other countries such as Philippines who has followed suit.

- Oil market situation in Thailand before deregulation (before May 1991)

Price structure

Before oil market deregulation was implemented in Thailand in May 1991, oil prices had been strictly controlled by the government. Retail, wholesale, ex-refinery and imported prices including marketing margins were established by the National Energy Policy Office (NEPO), based on Singapore Prices

PRICE STRUCTURE BEFORE DEREGULATION
(BEFORE JAN 24, 1991)



source : National Energy Policy Office (NEPO)

- Ex-refinery prices of petroleum products were controlled and based on the Average of Singapore Posting Prices, and import prices were also controlled and based on Singapore Spot Prices, plus freight and insurance. These prices changed on a weekly basis, according to changes on Singapore prices.

- Taxes were fixed and only occasionally changed.

- The Oil Fund was adjusted in order to keep wholesale prices stable

— Wholesale prices were controlled and established by NEPO and changed along with retail prices.

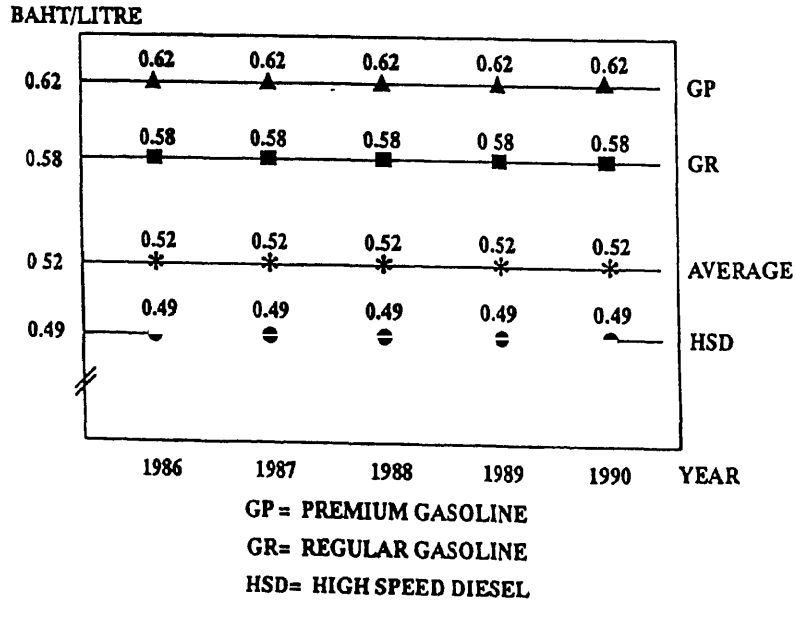
— Marketing margin for each product was fixed and had not been changed for over 5 years prior to deregulation.

— Retail prices which included fixed marketing margin were determined by NEPO and announced by Ministry of Commerce (MOC) Retail prices changes were made only when there were significant changes in the international market. It happened that changes of retail prices were sensitive and could largely impact the government stability.

— Wholesale and retail prices were stabilized by the Oil Fund in order that they could be retained at the controlled level.

Marketing margin

MARKETING MARGIN BEFORE DEREGULATION



source : National Energy Policy Office (NEPO)

Under regulated market, marketing margin for petroleum products in Thailand were fixed for a long period of time at 0 62 baht/litre for premium gasoline, 0 58 baht/litre for regular gasoline and 0 49 baht/litre for high speed diesel, or at the average of 0.52 baht/litre before May 1991. These margins were usually shared equally between oil companies and their dealers, in case the service stations were owned and operated by the dealers.

Number of oil companies and service stations

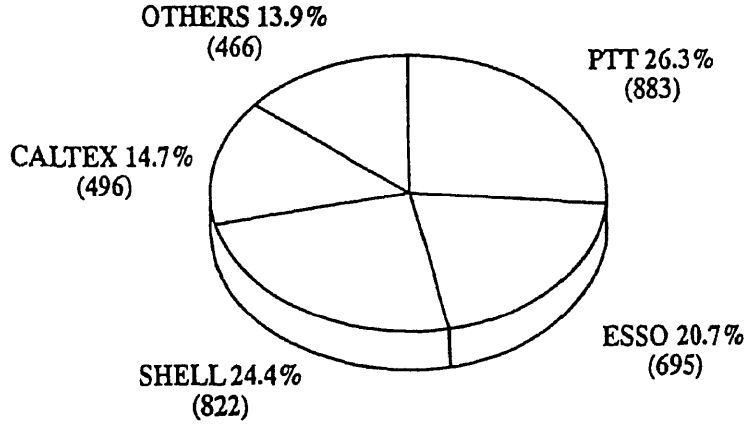
Prior to oil market deregulation in 1991, Thai oil industry was dominated by 4 major oil companies namely;

1. Petroleum Authority of Thailand (PTT)
2. Esso Standard Thailand Limited (Esso)
3. Shell Company of Thailand Limited (Shell)
4. Caltex Oil (Thailand) Limited (Caltex)

and a few small players

OUTLET SHARE BEFORE DEREGULATION

(AS OF DECEMBER 31, 1990)



TOTAL 3,362 SERVICE STATIONS

source : Ministry of Commerce (MOC)

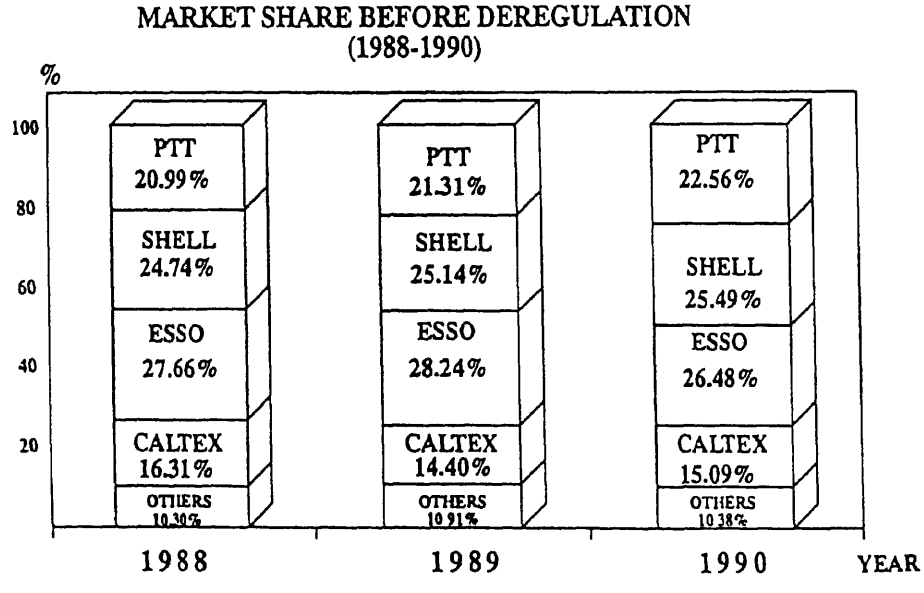
In 1990 there were total of 3,362 service stations throughout the country and each company's share of service station was

26.3%	for	PTT	or	883	stations
20.7%	for	Esso	or	695	stations
24.4%	for	Shell	or	822	stations
14.7%	for	Caltex	or	496	stations

13.9% for all other smaller scale oil companies or 466 stations altogether.

Market share

During the years 1988 to 1990, the oil companies in Thailand had their shares in the country's oil market, excluding the fuel oil sales to Electrical Generating Authority of Thailand (EGAT), as follows



*MARKET SHARE EXCLUDED FO -EGAT

source : Ministry of Commerce (MOC)

Esso had 27.66% in 1988, while Shell shared 24.74%, PTT's share accounted f 20 99% and Caltex 16 31%, the rest 10.30% belonged to other small players. In 1)0, prior to deregulation, market share of Esso, Shell, PTT, Caltex and others were 26 3%, 25.49%, 22.56%, 15.09% and 10.38% respectively.

- Reasons Thailand deregulated its oil market

Deregulation in Thailand was initiated in 1986 and the government had the objective to fully deregulate oil market before the end of our 'Sixth National Economic and Social Development Plan' (1987-1991). Deregulation in oil market and prices would allow oil pricing mechanism to truly reflect its real economical costs and encourage the effective usage and utilization of oil in the country, where oil import is essential In addition, deregulation shall allow oil pricing to be immune to political influence.

- Steps towards oil market deregulation in Thailand

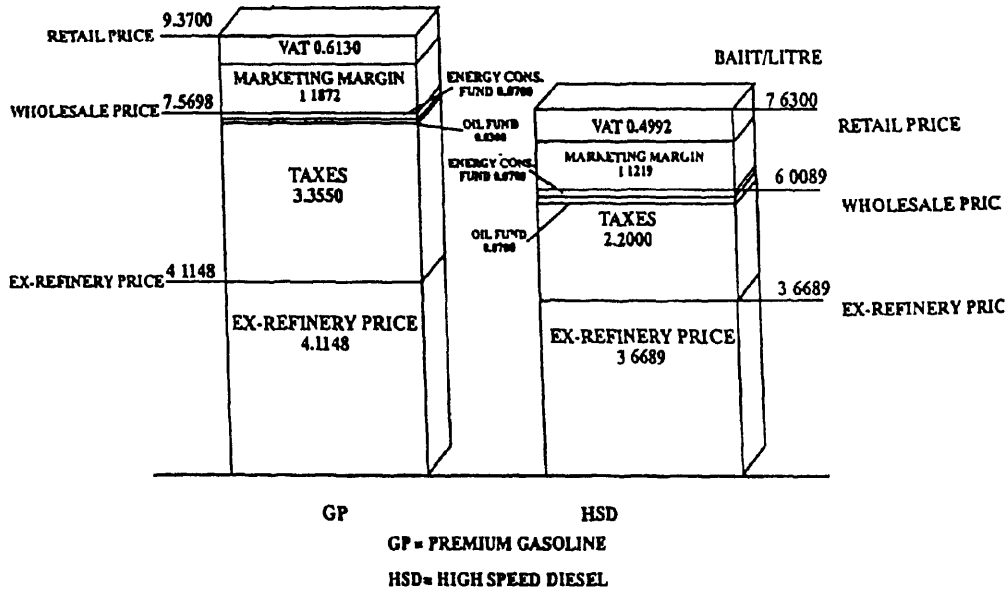
1. Partial deregulation was scheduled to take effect on May 27, 1991.
   - Ex-refinery and import prices were still controlled based on Singapore Posting and Spot prices respectively.
   - Wholesale prices were under controlled as well, and changed weekly in response to changes on ex-refinery and import controlled prices.
   - Taxes were fixed and also was the Oil Fund, but at the very minimal rate.
   - Only retail sales at the service stations were allowed to be priced by the oil companies at this first step of deregulation In another word, marketing margins are freely determined by the oil companies.
2. Full deregulation was implemented on August 19, 1991 or about three months after partial deregulation At this stage, the government only fixed tax rates and the Oil Fund Free pricing were allowed for ex-refinery, import, wholesale and retail prices including marketing margins.

Timing of our deregulation was of the essence. Thailand had prepared itself for deregulation by encouraging more oil companies and service stations in the country, abolishing product import quota system, reducing the Oil Fund, promoting the expansion and establishment of refineries, and improving the efficiency of oil distribution system throughout the country, including motivating the public with this scheme. By the time of deregulation, all concerned parties were very much ready, coupled with the world price decrease, when the government decided to float the retail prices, they had been successfully brought down. This reduction on oil prices enhanced very good impression and satisfaction to the public

- Oil market situation in Thailand after deregulation (after August 1991)

Price structure

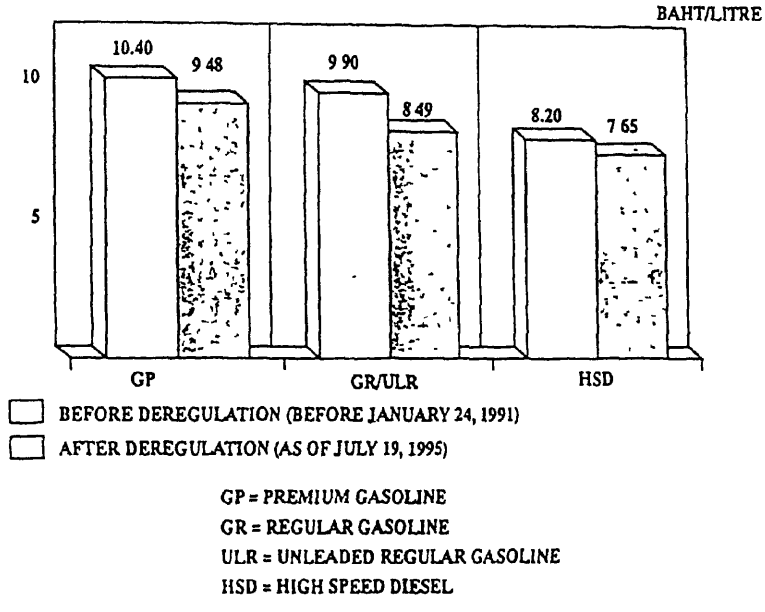
PRICE STRUCTURE AFTER DEREGULATION
(AS OF JULY 19, 1995)



source : Petroleum Authority of Thailand (PTT)

After oil prices control ceased to have effect, ex-refinery, import, wholesale and retail prices including marketing margins have been determined by market force, only taxes and the Oil Fund were remained to be fixed Ex-refinery prices are based on negotiations between the refineries and marketing companies, and found to relate to Singapore market without any interference from the government. Import prices are the real cost of product importation The public are now familiar with changes of oil prices that occur regularly, and retail prices vary in different locations according to cost of delivery of the products to each location However, if marketing margins are found to be beyond the reasonable level, NEPO shall intervene to stabilize the sensible margin

RETAIL PRICE BEFORE/ AFTER DEREGULATION

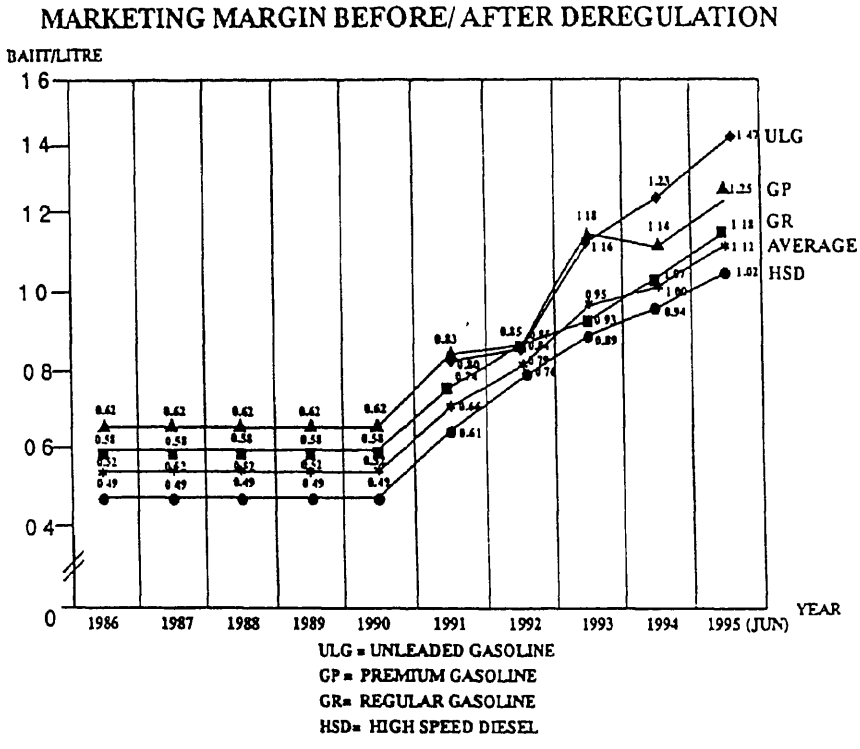


source : National Energy Policy Office (NEPO) and Petroleum Authority of Thailand (PTT)

As of July 19, 1995 retail price of premium gasoline decreased from 10.40 baht/litre before deregulation, to 9.48 baht/litre. Regular gasoline price dropped from 9 90 baht/litre to 8.49 baht/litre and high speed diesel from 8 20 baht/litre to 7 65 baht/litre

Marketing margin

Marketing margin on oil products, on the other hand, were increased after deregulation and varied in different areas, also in accordance with the difference of cost of products and competitive circumstances



source National Energy Policy Office (NEPO)

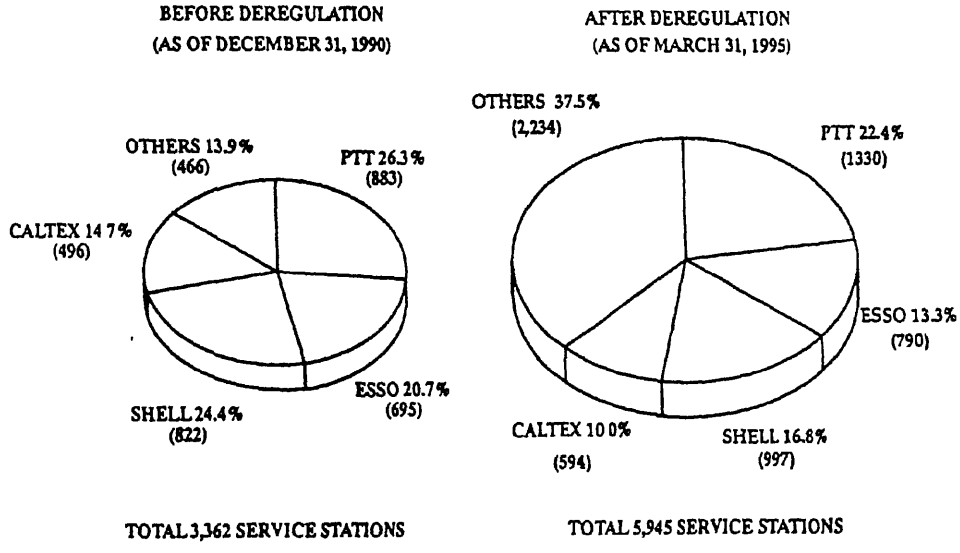
By June 1995, marketing margin for premium gasoline increased to 1 25 baht/litre, regular gasoline 1.18 baht/litre and high speed diesel 1.02 baht/litre On the average, marketing margin on petroleum products have increased 115% from prior to deregulation

Marketing margin have increased after deregulation due to the fact that it had not been changed since 1986, despite the continual increases in cost of living allowance, inflation, land price, expenses and others Oil compulsory reserve was also escalated to 5% from 3% of the annual sales In addition to the afore-mentioned, oil companies have provided superior quality in both products and services. Additive detergents have been mixed in the oil products to promote high environmental and safety standards

Number of oil companies and service stations

Our success in oil price deregulation has resulted in much better climate for investors and higher competition Number of oil companies were increased They are both major oil companies and newly established oil business entities Today, there are 25 oil companies operating in Thailand.

OUTLET SHARE BEFORE/ AFTER DEREGULATION



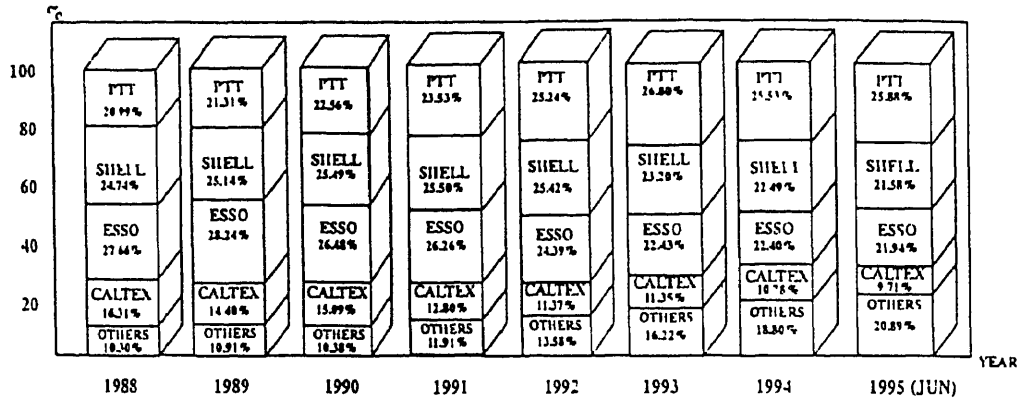
source : Ministry of Commerce (MOC)

Number of service stations were also increased. As of March, 1995 there were 5,945 stations in our country, indicating the 76.8% increase from before deregulation

Market Share

Due to the fierce competition as the conditions of the market became more aggressive and complex, with a rather high number of players in oil business, major oil companies' share in the market has deescalated. New entrants and small players have considerably gained their shares in the market.

MARKET SHARE BEFORE/ AFTER DEREGULATION



*MARKET SHARE EXCLUDED FO-EGAT

source . Ministry of Commerce (MOC)

Excluding fuel oil sales to EGAT, PTT's share in the market accounts for 25 88% in 1995, which is the largest in the industry, followed by Esso at 21 94%, Shell 21 58%, Caltex 9 71% and others 20 89%

- PTT's role as the state enterprise in deregulation scheme

PTT was established in 1978 and is 100% owned by the government as an attempt to solve Thailand's short and long-term energy problems PTT's commitment is to achieve its target as an instrument in securing national energy and resulting economical stability

With regards to deregulation, PTT has been given the responsibility of price sanctions, in case oil prices set by other private oil companies are too high, PTT shall price its products at the level acceptable by the public and fair for consumers, and most other oil companies usually follow suit PTT is able to lead the market due to its highest market share and its efficient retail network and distribution facilities around the country.

- Result of oil market deregulation in Thailand

Key of success

The government had strong determination to liberalize oil market and been well prepared for deregulation. Clear policy and message were given to all concerned parties, especially the oil companies and the public. All necessary measures had been taken prior to the implementation such as increase in numbers of oil companies and service stations, efficient distribution facilities, assignment of PTT as the price leader, introduction of partial deregulation first, once success and accustomed to oil companies, dealers and consumers, full deregulation was implemented.

Key of success in our deregulation can be summarized as follows,

- The government had successfully created competition in oil sector by relaxing rules and regulations on the establishement of more oil companies and service stations.
- Free import of petroleum products was allowed which had caused additional competitiveness.
- In term of oil distribution, PTT as the government's tool has been capable to influence the market to establish a reasonable margin, due to its largest market size and facilities As for the supply of products, two thirds of local refining capacity is in hand of the government, ensuring supply availability and reasonable ex-refinery prices
- Pump prices are set by the oil companies and dealers always comply with these prices
- Timing of our deregulation also had significant contribution to its success Oil prices in the world market had been relatively low at time of deregulation which supported the lower level of prices after deregulation and the Oil Fund were reduced to its minimal

Benefit for consumers

Prices of oil changed regularly in response to world market and independent from political influence Higher competition provided variety of choices for consumers to select the best for their satisfaction Oil companies improved their product quality and services to meet the consumers' expectation, as the sophistication of customers is increasing rapidly.

Benefit for oil companies

Oil companies are beneficial from a suitable margin determined by market force which is more realistic and free from political involvement. The more relax on certain rules and regulation

have allowed a much better climate for oil companies on investment of their facilities, expansion of refineries and setting up more retail stations and related business. Improvement on products quality and services generate reasonable return. Non-oil services have been established to enhance services at service stations and to create supplementary income to a station.

- Government's role after deregulation

After full deregulation, the government has continued to monitor the oil market in order to protect consumers' benefit. There is a mechanism to keep marketing margin of the oil companies at the suitable level and fair for both consumers and oil companies. If marketing margins are too high, NEPO as the government's body, shall direct the oil companies to make adjustment. PTT is still performing as the government instrument to balance the market and as the guidance to other oil companies following the oil policy.

The government has carefully evaluated the result of deregulation and been satisfied that its goal was successfully achieved. However, the government has continually monitored the oil market in Thailand and evolve policies to assure the consumers' best interest, as well as put efforts to narrow the gap of oil prices between in Bangkok and other provinces.

- Conclusion

After deregulation, competition in the oil business in Thailand has increased than ever before Opportunities were widely opened for small oil traders. Participants in this highly competitive retail market included both new entrants and small players. Many of these upstarts are Thai-owned, and highlight a trend away from the Thai oil industry's domination by foreign multinationals towards a relatively level playing field on which Thai companies are capable of winning. The growth of the new entrants had a pronounced effect on the market shares of the four big players in the Thai market. The Thai government considers this a successful development in view of its determination to spread the benefit of the oil industry around more evenly in line with the tenets of free trade and competitive pricing. Many of the oil companies have responded to this new situation by developing more aggressive marketing strategies designed to protect, regain or even add to their market shares. Such strategies comprise not only pricing, service stations and product development, but also quality and convenience of services, including commercial and sales promotion

---

References :

Process of Decontrolling Petroleum Product Prices - Oil Price Readjustment Committee, National Energy Policy Office

BIO-DATA

NAME	Mr. Prasert Bunsumpun
DATE OF BIRTH	February 20, 1952
NATIONALITY	Thai
MARITAL STATUS	Married, 1 daughter
ADDRESS	91/34 Wattananiwate Soi 4, Sudhisan Road
	Bangkok 10310, Thailand

EDUCATION

1975	B.Eng (Civil), Chulalongkorn University, Thailand
1977	MBA , Utah State University, USA

EXPERIENCES

1977-1981	Analyst, Esso Standard Thailand Ltd
1981-1982	Marketing Manager, Berlijucker Co ,Ltd
1982-1983	Manager, Transportation & Contract Division, Petroleum Authority of Thailand
1984-1986	Director, Transportations Department, PTT
1985-1986	Manager, Administration Department, Bangchak Petroleum Co.,Ltd. (BCP)
1986-1987	Assistant Managing Director, BCP
1986-1991	Director, Petroleum Procurement & Contract Department, PTT
1991	Assistant Governor, Marketing, PTT
1992-present	Senior Vice President, Downstream Oil Business Marketing, PTT

OTHER DESIGNATIONS

Director, Bangchak Petroleum Co.,Ltd

Director, Vietman LPG Co.,Ltd. (in Vietnam)

Director, PetroAsia (Thailand) Co.,Ltd

Director, PetroAsia (Maoming) Co ,Ltd. (in China)

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL IV

FINANCING OIL & GAS PROJECTS IN INDIA

PANEL CHAIRMAN : MR R N MALHOTRA
Chairman
Indian Council for Research and
International Economic Relations
New Delhi, India

PANELLISTS :

DR ANIL K MALHOTRA
Energy Advisor for Asia
The World Bank
Washington D C, U SA

MR DAVID M GRAY
Equity Capital Markets Director
HSBC Investment Bank
London, UK

MR ANTHONY M DOLS
Senior VP & Senior Relationship Manager
Natural Resources
ABN-Amro Bank N.V
Amsterdam, The Netherlands

DR C S CHUNG
Senior Project Specialist
Asian Development Bank
Manila, Philippines

DR A BHATTACHARYYA
Economic Advisor
Oil & Naturall Gas Corporation
New Delhi, India

R N MALHOTRA
Chairman,
Indian Council for Research and
International Economic Relations,
New Delhi

REFORM & RESTRUCTURING IN THE HYDROCARBON SECTOR

DR ANIL K MALHOTRA
Energy Advisor for Asia
The World Bank
Washington D.C., USA

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR ANIL K MALHOTRA
Energy Advisor for Asia, The World Bank
New Delhi, India

Dr Anil K Malhotra obtained his B Tech (Hons) degree from The Indian Institute of Technology (Kharagpur) M S from Massachusetts Institute of Technology, Doctor of Engineering from University of California (Berkeley) and a management degree from Harvard Business School

He started his professional career as a Consulting Engineer in Cambridge, Massachusetts in 1962 working on complex space vehicles and structure design Topping the national list of civil engineers, he joined the Indian Railway Service of Engineers as a bridge engineer and worked in this premier technical civil service for some years before moving to the oil industry In 1970 he joined Engineers Limited the largest public sector consultancy organisation in Asia to set up and organise their ocean engineering as well as their corporate planning and development division In 1980 he was appointed to the Board of Oil & Natural Gas Commission the Indian national oil company, as Member (Offshore) During his tenure the offshore oil production in India increased five times reducing the crude import requirements of the country by over 15 million tons per annum In 1984 he took over as Member (Operations) responsible for all operations for production of oil, gas and LPG with sales revenue of over US$6 billion, and a staff of over 30 000, including 8,000 scientists and engineers

He moved over to the World Bank in 1986, and is now the Senior Energy Specialist in its Asia region

During 1971-74 he was a member of the 10-man Indian National Committee on Science and Technology, the apex body advising the Union Cabinet on all matters pertaining to science and technology and was responsible for the preparation of the Science & Technology Plan as Chairman of the panels on marine resources, urbanization, utilization of wastes, and agreements on foreign collaboration He has been on the board of directors of a number of institutions and companies including Indian Institute of Technology at Kanpur Mazagaon Docks Limited Oil India Limited Rashtriya Chemicals and Fertilizers Ltd Hydrocarbons India Ltd Vice-Chairman of DNV's India Committee and Chairman of American Bureau of Shipping's India Committee

Dr Malhotra has authored a number of professional articles, publications etc and a book entitled "An introduction to Ocean Science and Technology "

THE ROLE OF INTERNATIONAL EQUITY MARKETS IN SUPPLYING CAPITAL FOR THE OIL INDUSTRY

MR DAVID M GRAY
Equity Capital Markets Director
HSBC Investment Bank
London, UK

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR DAVID M GRAY
Equity Capital Markets Director, HSBC Investment Bank
London, UK

DATE OF BIRTH 4th May 1952

EDUCATION M A Natural Sciences, St John's College Cambridge

CAREER

1982 -1995 **James Capel & Co./HSBC Investment Bank**

James Capel & Co was acquired by the Hong Kong and Shanghai Banking Corporation in 1986 and is now the equity distribution arm of HSBC Investment Bank, which co-ordinates the HSBC Group's merchant banking, securities and asset management activities

1994 - Director - Equity Capital Markets
Specialist in equity fund raising in the Oil & Utilities Sectors

1992 - 1994 Director - Head of UK Research

1982 - 1992 Investment Analyst
Head of Oil & Utilities sector research team
No 1 rated UK oil analyst 1986 - 1990

Head of James Capel team which acted as broking advisor and lead broker to HM Government on the privatisation of the electricity supply industry in England & Wales

Involved in James Capel team acting as joint broker to HM Government on the privatisation of British Gas

Member of UK Oil Industry Accounting Committee, 1985-1989

1973 - 1981 **Williams de Broe Hill Chaplin & Co.**

Stockbrokers, London
Investment analyst - Oil Sector

FINANCING OF OIL AND GAS PROJECTS WITH SPECIAL REFERANCE TO PROJECT FINANCE

MR ANTHONY M DOLS
Senior VP & Senior Relationship Manager
ABN-Amro Bank N.V.
Amsterdam, The Netherlands

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR ANTHONY M DOLS
Senior Vice President and Senior Relationship Manager, Natural Resources
ABN AMRO Bank N V , Amsterdam Netherlands

As Relationship Manager, Natural Resources of the ABN AMRO Bank in Amsterdam Netherlands Anthony Dols is responsible for the worldwide commercial banking business of ABN AMRO Bank with major oil and gas, and mining companies Prior to this position, Anthony worked for several years in the Oil and Gas group of the Project Finance department also at ABN AMRO Bank, and was involved in the arranging of debt financing for a large number of ventures of the industry including oil and gas field developments, refinery and petrochemical projects, and LNG projects

Mr Dols who joined the bank in 1990 worked for 9 years in oil and gas in the Far East, Middle East and Europe and gathered extensive experience in the evaluation and execution of projects in positions of Project Manger and Petroleum Economist He holds a Masters Degree in Engineering and Economics from the Technical University of Twente in the Netherlands

FINANCING OIL AND GAS PROJECTS IN INDIA

DR C S CHUNG
Senior Project Specialist
Asian Development Bank
Manila, Philippines

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR C S CHUNG
Senior Project Specialist, Asian Development Bank
Manila Philippines

1 Born in Chinju, Korea on 25 January, 1942

2 Graduated from Seoul National University with B S Degree in Electrical Engineering

3 Graduated from Stanford University with M S Degree in Industrial Engineering

4 Graduated from the University of Santo Tomas with Ph D Degree in Business Administration

5 Worked with Gold Star Company and the Korea Development Bank in Seoul Korea

6 Currently working with the Asian Development Bank since 1978 in the Industry & Energy Sector

DR A BHATTACHARYYA
Economic Advisor
Oil and Natural Gas Corporation
New Delhi, India

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

INDIA : ASIA'S EMERGING OIL GIANT

Chairmen & Panellists

Tuesday September 26 1995

PANEL CHAIRMEN

Mr Prabir Sengupta	Advisor (Energy), Planning Commission, Government of India, New Delhi, India
Mr Rajendra Singh	Chairman and Managing Director, National Thermal Power Corporation Ltd (NTPC), New Delhi, India
Dr Fereidun Fesharaki	Director, Program on Resources, East-West Center, Hawaii, USA
Mr RK Batra	Advisor, Corporate Sector, Tata Energy Research Institute (TERI) New Delhi, India
Dr Rakesh Mohan (subject to final confirmation)	Economic Advisor, Ministry of Industry, Government of India

PANELLISTS

Mr Shiv Narain Mathur	Director (Production), Hindustan Petroleum Corporation Ltd, Bombay, India
Mr S N Jha	Executive Director (Operations), Indian Oil Corporation Ltd, R & P Division, New Delhi, India
Mr Everett Lewis	Refinery Project Executive, Oman Oil Company Inc , Houston, USA
Mr Lars Reierson	Equity Research Analyst, Morgan Stanley & Co, Singapore
Mr Vikram Singh Mehta	Managing Director, Bharat Shell Ltd,(a joint venture between Bharat Petroleum Corp & Shell Overseas Investments B V), Bombay, India

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

Chairmen & Panellists

Tuesday September 26 1995

PANELLISTS

Mr O N Marwaha	Executive Director (LPG), Indian Oil Corporation Ltd, New Delhi, India
Mr A P Chaudhri	Executive Director, Center for High Technology, New Delhi, India
Mr Peter M Roberts	Project Executive, Oman India Pipeline, Oman Oil Company Inc, Houston, USA
Mr S C Mathur	Director (Finance) Indian Oil Corporation Ltd New Delhi, India
Mr Trevor Christmas	Director of Business Development, International Petroleum Exchange of London Limited, United Kingdom
Mr L Madison Galbraith	Managing Director, Commodity Advisory Service Group, Global Commodities, New York, USA
Mr Steven K Welch	Vice-President, International Business Development, Amoco Petroleum Products, Chicago, USA
Mr Franz B Ehrhardt	Executive Consultant, Frontier Business Development, Downstream Operations, Conoco Inc, Houston, USA
Mr Thomas E Fisher	Corporate Vice President, Commercial Affairs, Unocal Corporation, USA
Mr R A Shanbhag	Executive Director (I/G) Pipelines, Indian Oil Corporation Ltd, New Delhi, India
Mr S Behuria	Executive Director (Sales), Bharat Petroleum Corp Ltd, Bombay, India
Mr Gerrit Stofregen	President, Paktank Asia-Pacific Ltd, Hongkong
Mr Shanti Narain*	Advisor (Traffic), Railway Board, India

** (subject to final confirmation)*

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL V

OUTLOOK FOR NEW REFINING CAPACITY

PANEL CHAIRMAN : MR PRABIR SENGUPTA
Advisor (Energy)
Planning Commission, Government of India

PANELLISTS : MR S N MATHUR
Director (Production)
Hindustan Petroleum Corporation Ltd
Bombay, India

MR S N JHA
Executive Director (Operations)
Indian Oil Corporation Ltd
New Delhi, India

MR EVERETT LEWIS
Refinery Project Executive
Oman Oil Company Inc
Houston, USA

MR LARS REIERSON
Equity Research Analyst
Morgan Stanley & Co
Singapore

PRABIR SENGUPTA
Advisor (Energy),
Planning Commission,
Government of India

TECHNOLOGY UPGRADATION OF INDIAN REFINERIES

MR S N MATHUR
Director (Production)
Hindustan Petroleum Corporation Ltd.
Bombay, India

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR SHIV NARAIN MATHUR
Director (Production) Hindustan Petroleum Corporation Ltd.
Bombay, India

Education

A graduate Chemical Engineer from Indian Institute of Technology Powai Bombay

Experience

Has over 28 years of experience in the Petroleum Industry and Government of India

(a) Worked in Petroleum Refineries from 1966 to 1978 (12 years)

- ESSO Refinery, Bombay, India
- ESSO Refinery, Port Dickson, Malaysia
- HPCL Refinery, Bombay India

(b) Worked from 1978-1985 (7 yrs) in Oil Coordination, New Delhi as Head of Technical Department responsible for Refining and Marketing Functions

(c) Worked in Corporate Planning from 1985 to 1987 (2 years)

(d) Worked as Advisor (Refineries) in the Ministry of Petroleum & Natural Gas from 1987 to 1991 (4 years)

Current Designation

Director - Production (Since 1991)
Hindustan Petroleum Corporation Limited, Bombay

Others

a) Served as Government Director on the Boards of Madras Refineries Ltd Cochin Refineries Ltd Bongaigaon Refineries & Petrochemicals Ltd, and Lubrizol India Ltd for 4 years

b) Has travelled extensively abroad for Seminars Conferences often as a member of several delegations

c) Has been a member of several Government Committees relating to setting up of new refineries Safety in Refineries and Marketing etc

d) Has been involved in large number of studies relating to crude Transportation Crude Quality, Refining, Marketing, and Supply & Distribution

OUTLOOK FOR NEW REFINING CAPACITY IN INDIA: 1995 - 2005

MR S N JHA
Executive Director (Operations)
Indian Oil Corporation
New Delhi, India

OUTLOOK OF REFINING INDUSTRY IN INDIA:1995-2010

SYNOPSIS

Refining industry, world-wide is facing stiff challenges in terms of quality of crudes, environmental regulations stipulating stringent product specifications, fluctuating demand of petroleum products, decreasing refining margins etc In addition to these global issues, the refining sector in Asia Pacific region is also encountered with crude availability problem which is a matter of serious concern. The total crude oil production in the region is estimated to be approx. 7.0 million bbl/day (350 MMTPA) against the estimated demand of 22.0 million bbl/day (1100 MMTPA) by the year 2005

The growth of Indian oil industry and associated refining sector is similar to Asia Pacific region Due to rapid urbanisation and industrialisation, high demand for transportation fuels etc., India's primary energy consumption has doubled during last decade and is projected to grow at an impressive rate of 5-6% per annum over the next decade One third of India's primary energy requirement is met through petroleum products. The crude oil demand which is at present 65 3 MMTPA is expected to touch a level of 150 MMTPA by the year 2010, whereas, indigenous crude oil production is less than half of its present requirement. Hence India would have to resort to large scale imports of crude oil & petroleum products In order to bridge this large mismatch between supply and demand of petroleum products in the country, huge investments of around US$ 110 billion would be required to establish new oil reserves, additional refining capacity and other necessary infrastructure in next 10-15 years.

Govt. of India under its economic reforms and liberalisation policies have opened up the refining industry to foreign participants The total refining capacity in India is presently 57 4 MMTPA The refineries in India at present are controlled and operated by state owned organisations like Indian Oil Corporation Limited, Hindustan Petroleum Corporation Limited, Bharat Petroleum Corporation Limited, Madras Refineries Limited, Cochin Refineries Limited, and

Bongaigaon Refineries and Petrochemicals Limited. In order to meet the increasing demand of petroleum products, additional refining capacity is being provided in the country through low cost expansion of existing refineries and also through new grass root refineries. A number of refineries under private sector as well as under joint sector are planned to be installed during next five years. Based on the present projections, the country will have 120 MMTPA of refining capacity by the year 2000. However, in order to meet the deficit of petroleum products, particularly middle distillates, an additional refining capacity of 30 to 40 MMTPA would be required in the country by the year 2010

Apart from increased capacity requirement, the refining industry in India is addressing two major issues i.e. achieving the stringent product quality requirements and residue upgradation to reduce the bottom of the barrel. With a great concern for environment protection, Government of India is stipulating stringent specifications for transportation fuels particularly Gasoline and HSD. In order to meet the stringent quality requirements, Indian refining industry would have to spent about US$ 1-2 billion in the coming decade.

With diminishing demand for fuel oil and crude becoming heavier, huge investment towards adoption of new technologies is required to upgrade heavier ends to light and middle distillates. However, there is no single optimum configuration which can be directly adopted. Various parameters viz. investment, product slate, return on investment etc. are to be looked into before selecting any combination of residue upgradation technologies.

OUTLOOK OF REFINING INDUSTRY IN INDIA:1995-2010

1.0 INTRODUCTION :

World-wide refining industry is facing stiff challenges in terms of changing quality of crudes, strict environmental regulations leading to stringent product specifications, changing product mix, fluctuating demand of petroleum products, economics of refining operations etc. The refining issues are divided into following categories : -

- Supply and demand of petroleum products.
- Refining capacity.
- Product quality.
- Residue upgradation
- Refinery margins.

2.0 SUPPLY & DEMAND OF PETROLEUM PRODUCTS :

2.1 Energy consumption in the world has grown steadily in line with population and economic growth. During 1983-1993 period, primary energy demand has grown at annual rate of 1.95% and the growth is predicted to touch a level of around 2.6% between 1995-2010(Fig. 1). However, due to rapid industrialisation, growth is projected to be much faster in Asia-Pacific region. Amongst the various primary energy resources, Crude oil would remain the single largest resource because of its predominant role in transportation fuel. Presently, crude oil share which is around 40% of energy market, is predicted to decline to a level of about 38% by 2010 due to development of nuclear power and increased use of Natural Gas. However, crude oil demand is expected to grow @ 1.4% per year. As per estimates, crude oil consumption between the year 1993 and 2010 will increase from 3100 MMTPA to 4600 MMTPA. (Table 1)

As regards in Asia, Oil consumption has grown at a phenomenal rate of 5 1% during last decade due to region's booming economy Due to the combination of rapid industrialisation and urbanisation , it is expected that in the next decade, crude oil demand will continue to grow at a higher rate of around 3.0-3.5%. If this growth rate continues, crude oil consumption in Asia will be equal to that of North America by the year 2010. This increase accounts for nearly two third of total expected volume growth in world oil market between 1992 and 2005 Such strong demand growth in the region would make it a net importer of crude oil and oil products in the long term

In India, total energy consumption is around 202 MMTPA of oil equivalent (1993 data:Fig-2). Of this, consumption of petroleum products was 62.4 million MT. This represents per capita consumption of energy as 226 kg. of oil equivalent, and per capita consumption of oil as 70 kg which is much less than many industrialised countries in the world (Table 2). Indian primary energy consumption is expected to grow @ 5-6% annually over the next decade. Coal will continue to remain a dominant source due to its abundant availability. As per one estimate, crude oil demand is expected to be around 101 MMTPA by the end of eighth plan (2001-02) , 125 MMTPA by the end of 10th plan (2006-07) and around 150 MMTPA by the year 2010. The historic consumption and forecast of annual demand for crude oil in India is shown in Fig. 3

2.2 Crude Oil Availability

The proven world-wide reserves of crude oil and Reserves to Production (R/P) ratio in years is given in Table 3 Presently, the crude oil proven reserves in the world are estimated to be around 136.7 thousand million tonnes Even with no addition in reserves in future, world has enough crude oil to supply industry needs for more than 40 years at the 1994 consumption rate of 3100 MMTPA.

However, quality of crude oil discovered from new fields is an area of concern. Although, some light crudes have been discovered, the major addition to reserves have occurred in the Middle East and Latin America and have been heavy high sulphur crude oil. It is expected that in future, crudes will gradually become heavier and higher in sulphur content.

In Asia-Pacific region, crude oil production is not likely to grow substantially. From 6.76 million bbl/day (340 MMTPA) in 1993, it is expected to increase to app. 7.0 million bbl/day (350 MMTPA) in 2005. China and Indonesia who are presently oil producing countries, became net importer in 1993. It is estimated that while china will import 2.0 million bbl/day (100 MMTPA), Indonesia will import around 0.4 million bbl/day (20 MMTPA) of crude oil in 2005. Outlook for crude oil production in Asia Pacific Region is given in Table 4.

India currently has 0.76 billion tonnes of proven oil reserves. In order to meet the growing demand of petroleum products of more than 150 million tonnes/annum by 2010, around 2.3-3.0 billion tonnes of recoverable oil reserves are required. A lot more efforts in terms of latest technology leading to success in exploration and low development cost of wells would be required. Huge investment has to go into exploration activities in order to sustain the projected demand. According to an estimate, the investment required would be in the range of US$. 60 - 80 billion. Government of India has decided to throw open the exploration and drilling sector for private participation in order to fasten the activities in this area.

2.3 Product Demand

Around the world, the demand for middle distillates and gasoline is expected to grow at a rate of 1.6-1.7% per year. Naphtha and LPG are also expected to grow at a slightly higher rate compared to gasoline However, fuel oil consumption has declining trend at a rate of 0.2% per year. As fuel oil demand falls, the price differential between light and heavy crude oil increases. This provide an economic incentive to the refineries to process heavier crudes. However, heavy crudes produce disproportionate share of residual fuels and also have high sulphur content. Keeping this in view, existing and future refineries are looking for providing flexibility to install substantial conversion and desulphurisation capacities to produce required product slate.

In Asia pacific region, demand for gasoline and diesel will show remarkable increase. Gasoline is expected to grow @ 4.8% between 1993-2005 Likewise demand of gasoil

is projected to grow sharply from 4.10 million bbl/day (200 MMTPA) to 5.83 million bbl/day (290 MMTPA) in 2000 and 7.15 million bbl/day (360 MMTPA) in 2005, a growth of 4.7%. While, Naphtha growth is expected around 3.2%, Jet Fuel/Kerosene will also show a steady growth of 3.5% reflecting a high rate of increase in demand for Jet Fuels. Table 5 indicates a forecast of product wise demand in Asia Pacific region by the years 2000 and 2005.

Indian oil market is similar to other developing Asian markets. The demand is heavily focussed towards middle distillates. There is a large mismatch between supply and demand. India exports large amount of Naphtha and imports kerosene and diesel. India imported about 8.5 MMT of finished products during 1994-95. Based on various projections, India will be facing huge deficit of middle distillates in the next decade. Accordingly, Govt. of India has initiated appropriate measures to expand its refining capacity. It has opened up the industry to foreign participants and private sector. Existing refineries are also playing an active role in expansions of refining capacity. Present and projected demand of petroleum products is given in Table 6.

3.0 GLOBAL REFINING INDUSTRY

World-wide, there are around 170 refineries in United States alone followed by 135 refineries in Asia-Pacific region. Global distribution (region wise) is given below.

Region	*No. of Refineries*
United States	170
Asia/Pacific	135
Western Europe	115
Eastern Europe/FSU	90
South Africa/Caribbean	75
Africa	45
Middle East	40
Canada	25

About 50% of the refineries in US and Western Europe have capacities greater than 10.0 MMTPA. Table 7 indicates the capacities of crude and vacuum distillation and other secondary processing units of the world.

3.1 Refinery Capacity Utilisation

During 1980s, average refinery capacity utilisation in the world was only 70% which resulted in closure of less economic refineries. However, in subsequent years, the situation improved substantially and world-wide capacity utilisation improved to 88% in 1994 which is expected to stabilise at a level of 90% in future years Considering this level of capacity utilisation, app. 4350 MMTPA of refining capacity must be at place to meet the crude oil processing requirements by the year 2010 which amounts to an increase of 780 MMTPA refining capacity. Although much of the increased capacity will come from expansion of existing refineries, many new refineries will be required to meet the forecast demand of refined products.

3.2 Asia Pacific Region

In Asia Pacific region, 75% of the regions' refining capacity is concentrated in six countries i e Japan, China, South Korea, India , Indonesia and Singapore Due to industrialisation, there exists a demand for transportation fuels, power and increased energy use for having higher living standards. Asia's increasing oil demand represents almost 70% of world-wide growth To meet increasing demand of petroleum products, Asia Pacific's total refining capacity is likely to increase from 15.30 million bbl/day (765 MMTPA) in 1993 to 20.1 million bbl/day (1000 MMTPA) in 2005 (Table 8)

As per one estimate, 42 grassroots refineries are under construction & planning stage in the region. Total crude oil capacity of these projects is about 3.5 million bbl/day (175 MMTPA). Out of this, 1.3 million bbl/day (65 MMTPA) capacity is considered firm and another 1.3 million bbl/day (65 MMTPA) of refining capacity is

expected to be installed by expansion of existing refineries

4.0 INDIAN REFINING SCENARIO

The Indian oil industry can be divided into two distinct segments based on nature of activities. The upstream activity which involves exploration and production (E&P) of crude oil, and the downstream sector i.e. plain refining and refining plus marketing (R&M). The oil companies' presence in the further downstream petrochemicals business had been so far restricted to minor aromatics complexes producing Benzene and Toluene.

Till recently, exploration and production of crude oil, was only with Oil & Natural Gas Corporation Limited (ONGC) and Oil India Limited (OIL). OIL operates mainly in the north-eastern sector (in the Assam oil fields), whereas ONGC's activities are spread throughout the country. Over 60 per cent of its production is in the Bombay High offshore area. In 1983, ONGC produced 93 per cent and 90 per cent of India's total domestic crude and natural gas production respectively. With the opening up of this field for private companies, major multinational oil companies like Shell, Amoco etc. and some Indian private companies are participating in the exploration activities As a move towards upward integration, Refining companies viz IOCL, HPCL & BPCL are planning to form a joint venture for exploration and production of crude oil

The refining and marketing sector is dominated by the public sector companies such as Indian Oil Corporation (IOCL), Hindustan Petroleum Corporation Limited (HPCL), Bharat Petroleum Corporation Limited (BPCL). IOCL is the only company which is presently in Fortune 500 list. IOCL is also the canalising agent for oil imports in the country, has the highest refining capacity of 24.55 million tonnes There are expansion activities underway in some existing refineries to increase total capacity by 6 85 million tonnes. With this, the total capacity of IOCL refineries will increase to 31.40 million tonnes. HPCL has 10 million tonnes of refining capacity and also expanding capacity of its Vizag refinery by three million tonnes i e total capacity will increase to 13 million tonnes. BPCL with its only refinery at Bombay,

has a refining capacity of six million tonnes. IBP is a marketing company and does not own any refinery. Amongst the three stand-alone refineries, Madras Refineries Limited (MRL) currently has the capacity of seven million tonnes, with refineries at Manali and Narimanam. Cochin refineries Limited (CRL) has recently enhanced its capacity to 7.5 million tonnes after commissioning of expansion project of 3.0 MMTPA. Bongaigaon Refineries and Petrochemicals Limited (BRPL) has the lowest capacity among the stand-alone refineries with a capacity of 2.35 million tonnes. Present refining capacity scenario in the country is given in Table 9.

In order to meet the growing demand of petroleum products, additional refining capacity is required to be installed in the country. The additional refining capacity can be either through low cost expansion of existing refineries or through installation of new grass root refineries. New refineries are costlier than expansion of existing refineries. While the cost of setting up of a new one million tonne refinery capacity would be over US$ 200 million, an expansion would cost around US$ 100 million. In 1995, the country has a refining capacity of 57.40 million tonnes/annum and 9 85 million tonne refining capacity is expected to be added mainly from expansion of existing refineries. New refineries at Panipat and at Numaligarh in Assam are expected to generate 9 million tonnes of refining capacity.

There are a number of private sector refineries coming up after the Government opened up the sector to private participation. First amongst these refineries is, Mangalore Refineries and Petrochemicals (MRPL). With an installed capacity of three million tonnes, the project is scheduled for commissioning in July 1996. MRPL has plans to increase its capacity to nine million tonnes in phases.

The biggest project coming up in the private sector is Reliance Petroleum's 15 million tonne refinery. This is scheduled to be commissioned in 1997. Other than these, Essar Oil is also setting up a nine million-tonne refinery at Gujarat which is scheduled for commercial production in the first quarter of 1998. In addition, three refineries of 6.0 million tonne capacity are planned at Eastern, Western and Central part of India under joint sector. Considering the projects under

implementation /approved in private, public & joint ventures as well as low cost expansion of the existing refineries, total capacity will increase to a level of 120 million tonnes (Table 10). Even with these crude processing levels in the country, it is estimated that the total deficit of middle distillates by the year 2010 would be of the order of 21 million tonnes which corresponds to additional refining capacity requirements of 30-40 million tonnes. Keeping this in view, Government of India, during last one year, has given license to several industrial groups to set up small EOU refineries in the country (Table 11). It is estimated that private sector would participate only when they are assured of good rate of return.

5.0 ENVIRONMENTAL REGULATIONS/PRODUCT QUALITY ISSUES

World-wide public concern about deterioration of earth's environment is increasing day by day. Accordingly, Governments at all levels are responding by enacting more stringent laws and regulation covering raw materials, products, process technology, plant design, construction, operation and maintenance. Environmental regulations cover air, water quality, and hazardous and toxic substances.

The most demanding environmental regulation has occurred in the field of product quality particularly transportation fuels The impact of change in product quality is enormous and in some cases, the cost can seriously affect the economic viability of the plant. Future outlook of products specification in European countries is given in Table 11.

5.1 Gasoline:

Gasoline specifications has undergone severe changes and the same is becoming stringent day by day. In addition to lead phase out, some of the other changes taking place in gasoline specifications are.

- Low RVP to reduce Volatile Organic Components
- Oxygenate to reduce CO
- Reformulated Gasoline to control Ozone

By reducing gasoline RVP, evaporative emission of Volatile Organic Content (VOC) including Benzene can be minimised. Medium to high RVP is required in winter for easy engine start-up and rapid warm up, but in summer, the optimum RVP is around 78 psi depending upon the climate. Latest change in gasoline specification is introduction of reformulated gasoline in severe and extreme Ozone-non-attainment areas. Benzene and Oxygen contents have been precisely specified to control ground level ozone and smog formation

In line with changes taking place world-wide, in India also BIS has revised the specifications of Gasoline Specification to limit Benzene <5% by 2000 is likely to be brought down further in the range of 1-3%. The present and future outlook of gasoline specification in the country is given in Table 12

5.2 Technological Options to Meet Above Specification In Indian Context

In order to phase out lead in gasoline, new Catalytic Reforming Units (CRUs) are being installed in various refineries. However, addition of reformate of high octane will increase the benzene content to gasoline pool to around 7-10%. To meet the desired specifications of Benzene content, new units viz. alkylation , isomerisation and use of oxygenates such as Methyl Tertiary Butyl Ether (MTBE), Ethyl Tertiary Butyl Ether (ETBE) and Tertiary Amyl Ether (TAME) is required. As per rough estimates, an investment of US$ 90 million will be required to meet the Benzene spec. of 5%. If Benzene levels are further brought down to a level of 1%, the estimated loss of MS production will be in the range of 2 million tonnes. In order to reduce this huge loss of MS production, refineries will have to install additional facilities for hydroisomerisation of light reformate, isomerisation and dearomatisation of Naphtha and increased blending of oxygenate costing upto US$ 475 million. Still, MS production loss of the order of 0.25 million tonnes can not be avoided.

5.3 Diesel

Due to increased use of Diesel, the problems related to pollution i.e. emission of particulate and SO2 has increased substantially. Most of the countries have reduced/planning to reduce diesel sulphur limit to as low as 0.05%. Simultaneously, cetane specification will also be gradually increased. Present and future specification of Diesel in India is given in Table 13. As mentioned in the Table, a limit of 0.25% sulphur in Diesel is envisaged by 2000. To comply with this specification, an investment of US$ 1.0 billion will be required for installation of Hydro-desulphurisation units. The refineries processing Assam and low sulphur indigenous crude will not face problem in meeting the sulphur specification but have to incur additional expenditure on dosing of cetane improver to meet the proposed cetane specification of 48 by 2000.

6.0 RESIDUE UPGRADATION

With available crude becoming heavier and decreasing demand of fuel oil, new technologies are to be adopted for reduction of the bottom of the barrel. Three upgradation routes are available for bottom residue:-

Carbon Rejection:
- -Delayed coking
- -Visbreaking
- -Fluid Coking
- -Flexi Coking
- -Residue FCC

Hydrogen Addition·
- -Hydrotreating
- -Hydrorefining
- -Hydrocracking

.Physical Separation:
- -Solvent Deasphalting

Table 14 lists possible refining upgrade options.However, no single optimal configuration exists which can be directly adopted as refineries configuration is driven

by market demands. For example in US, FCC units and coker is considered as better option because of heavier crude slates, high gasoline and low residual fuel oil demand. In Europe, because of available fuel oil outlets, thermal cracking is substituted for Coking. In Japan, hydro-desulphurisation capacity for long residue is substantial because of low sulphur fuel oil market While selecting residue upgradation technology various factors viz. investment, product pattern, return on investment, product disposal etc. are looked into

A comparison of different process for residue upgradation , comparative performance of residue Upgradation process and optimum process configuration in Indian context are given in Table 15,16 & 17 respectively.

7.0 *REFINING MARGINS*

The Indian Oil industry is on threshold of major changes and it is coming out from a heavily controlled environment. The industry which was fully protected from global competition for last two decades, is now open to liberalised environment. All aspects of oil pricing are controlled by Government of India which allows subsidy to products for common use like Kerosene, Diesel and LPG which together accounts for nearly 59%.

The lubricants industry has been totally deregulated with freedom to import lube oil. All controls on import, blending and marketing of lubricants have been removed. Further, Govt. of India introduced Parallel Marketing Scheme (PMS) from February 1993 for products in short supply i.e. LPG, Kerosene and Low Sulphur Heavy Stock (LSHS). This scheme allowed private parties to import and market these products through their own distribution network at market determined prices. These policy measures have resulted in a number of international oil majors entering into tie-ups with Indian oil companies to market lubricants and products under PMS.

Refining margins (product realisation per barrel of crude refined less cost of crude and variable operating expenses) vary significantly across the globe. Critical factors affecting margins include the demand supply balance for products, growth rate in oil consumption, ease of access to markets and actual product mix of refineries. While petroleum product prices are determined

largely by local demand-supply considerations, the crude cost is more of a global nature, which result in varying margins. Under Market Driven Pricing Mechanism (MDPM) refining margins for Indian refineries will also be in line with other countries. MOP & NG has now drawn up plans to switch from existing Administered Pricing Mechanism (APM) to Market driven Pricing Mechanism (MDPM). To start with market based policy, decanalisation of imports & exports, rationalisation of tariff structure by duties on raw material and framing up of policy aimed to improve cost efficiencies of existing refineries and incentives for new investment are proposed to be implemented. It is expected that by 2001-2002, full decontrol will be in place.

7.0 CONCLUSION

In the coming decade, India is going to face huge deficit of petroleum products particularly middle distillates. To meet the large gap between supply and demand, Government of India has taken measures to expand the refining capacity in the country. As a result, the capacity is expected to increase from present level of 57.40 MMTPA to 120 MMTPA by the turn of the century and about 150 MMTPA by 2010 which is a great challenge to the industry. Existing as well new entrants will have to expand and/or build refineries with utmost urgency. Further, industry is also to face challenge of adopting newer technologies to meet increasing requirement of middle distillates & environment regulations for the refinery operations as well as product quality In this regard, following aspects are important:-

- Each refinery need to provide flexibility to process variety of crudes i.e. both light as well as heavy with high sulphur content
- Deployment of Resid processing technologies viz FCCU, Hydrocracking etc. to upgrade heavier ends.
- Adoption of technologies like hydrotreatment, hydro-desulpherisation, isomerisation etc. to meet stringent product quality likely to be enforced in future.

As can be seen from above, all new process technologies which are essential to meet present day need require substantial quantities of hydrogen for which dedicated hydrogen producing facilities will have to be installed.

Government of India has taken several policy measures to encourage private investment in this vital hydrocarbon industry. India, with huge reservoir of skilled manpower, high demand for petroleum products etc. provides good opportunity for investment. As mention above, Asia Pacific region is going to be a big importer of petroleum products in the next decade and therefore in the long run, the refining capacity in India can also be utilised for export of the petroleum products to other part of the Asia Pacific region in a cost effective manner .

Growth in World Energy Consumption

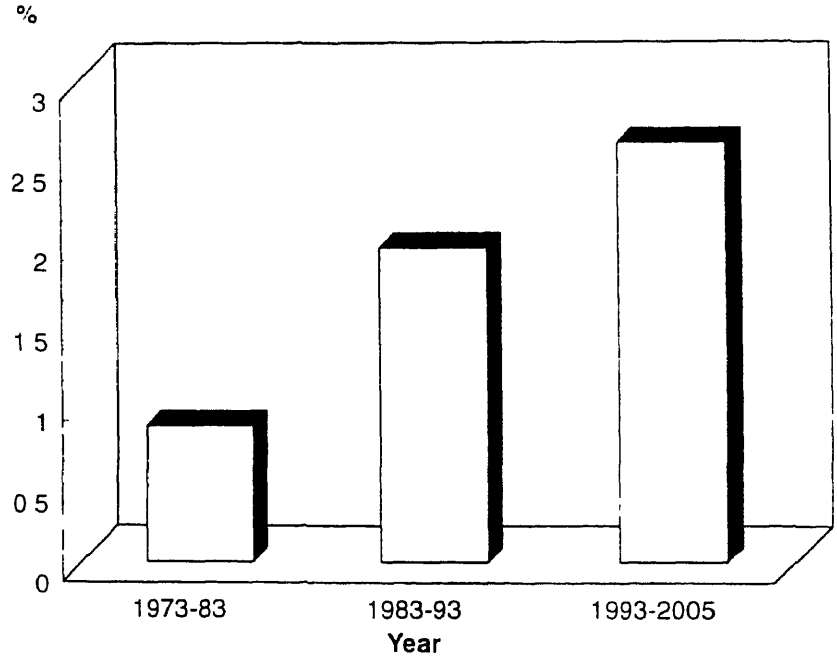


Fig 1

Indian Energy Consumption

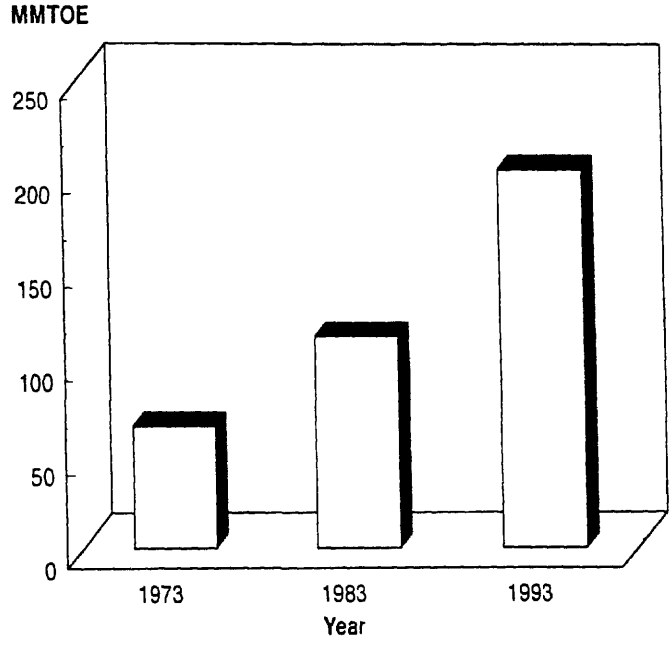


Fig 2

Crude Oil Consumption in India

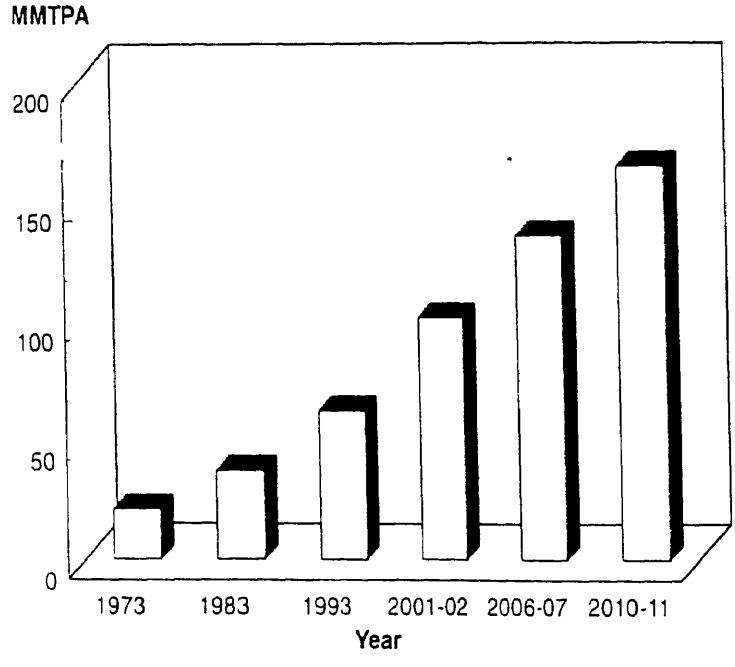


Fig 3

World Energy Consumption

(Fig in MMTOE)

	1973		*1983*		*1993*		*2010(Projected)*	
	Qty	*%*	*Qty*	*%*	*Qty*	*%*	*Qty*	*%*
Oil	2798	47.3	2765	43.1	3121	40.1	4607	37.9
Natural Gas	1066	18.0	1330	20.6	1787	22.9	2718	22.3
Coal	1668	28.2	1918	29.7	2141	27.4	3663	30.1
Hydro elect.	332	5.6	161	2.5	198	2.5	330	2.7
Nuclear & Others	49	0.9	258	4.1	557	7.2	851	7.0
Total	**5913**	**100**	**6432**	**100**	**7804**	**100**	**12169**	**100**

Table: ***1***

Annual Per Capita Consumption of Crude

(Fig. in Kg)

North America	3150
Japan	2010
N.Europe	1520
Asia- Australia	240
China	110
India	70
World Average	550

Table: 2

World Energy Resources

	Reserves	*R/P Ratio*
		Years
A. Oil (Thousand Million tonnes)	136.7	43.1
B. Natural Gas (Thousand Million tonnes Of Oil Equivalent)	122557	64.9
C. Coal Million tonnes	1039182	236

Table: 3

Crude Oil Production in Asia Pacific

(Fig in 000 bbl/day)

Country	1986	1993	2000*	2005*
China	2,620.0	2,888.0	3100~3300	3200~3400
India	625.0	550.0	600~700	700~800
Indonesia	1,390.0	1,528.0	1200~1400	1100~1300
Malaysia	503.0	648.0	650~700	600~650
Australia	513.0	520.0	400~450	200~250
Brunei	165 0	167.0	160~180	160~180
Papua New Guinea	-	126.0	80~100	60~80
Vietnam	-	122 0	300~400	350~450
The Philippines	6.9	9 1	50~70	70~90
Thailand Pakistan New Zealand	40 41 29	54 60 41	150~200	150~200
Others	37 0	43 0	40~50	40~50
Asia-Pacific Total	**5,970.0**	**6,756.0**	**7000~7200**	**7000~7200**

* Projected

Table: 4

Product Demand in Asia Pacific

(Fig in ,000 bbl/day)

Product	*1993*	*2000**	*2005**
Naphtha	1373	1782	2005
(% Share)	10	10	09
Gasoline	2555	3663	4492
(% Share)	18	20	21
Jet Fuel/ Kerosene	1537	2026	2326
(% share)	11	11	11
Gasoil	4101	5834	7153
(% Share)	29	32	33
Fuel Oil	2906	3011	3180
(%share)	20	16	15
Others	1725	2155	2474
(% Share)	12	12	11
Total	**14197**	**18469**	**21630**
(% Share)	**100**	**100**	**100**

* Projected

Table : 5

Demand for Petroleum products in India

(All figures in ,000 MT)

Product	***73-74***	***83-84***	***93-94****	***06-07***
LPG	269	746	3114	10148
MS	1507	1891	3833	9979
Naphtha	1534	2804	3371	7195
Others	175	159	680	1776
Total Light Distillates	***3485***	***5600***	***10998***	***29098***
ATF	778	1208	1742	3236
SKO	3294	5524	8784	11595
HSD	5404	12600	25844	56566
LDO	1278	1097	1338	1523
Others	212	222	432	844
Total Middle Distillates	***10966***	***20651***	***38140***	***73764***
Lubes	612	617	913	1467
FO/LSHS	5912	7558	9104	12626
Bitumen	1066	1050	1843	2882
Others	305	365	1345	4212
Total Hy Ends	***7895***	***9590***	***13205***	***21187***
Total All Products	***22346***	***35841***	***62343***	***124049***

* Projected

Table : 6

World wide Primary & Conversion Units Capacities

(Fig in million bbl/cd)

Region	*Crude*	*Vacuum Distill-ation*	*Cat. Cracking*	*Cataly. Reform-ing*	*Catalytic Hydrocra-cking*
Asia Pacific	14.4	3.2	2.1	1.4	0.5
Western Europe	14.2	5.2	2.1	2.2	0.7
Eastern Europe & CIS	12.8	3.7	0.7	1.5	0.1
Middle East	5.3	1.6	0.3	0.5	0.4
Africa	2.8	0.5	0.2	0.3	0.1
North America	18.7	8.1	6.0	4.2	1.5
South America/ Carribbean	5.8	2.5	1.0	0.3	0.1
Total	74.0	24.8	12.4	10.4	3.4

Table : 7

Refining Capacity in Asia Pacific

(Fig in ,000 bbl/day)

Country	1993	2000*	2005*
Japan	5005	5500	5500
ROK	1675	2488	2488
Taiwan	600	720	900
Singapore	1085	1135	1135
Indonesia	856	1011	1131
Malaysia	230	450	450
Thailand	395	780	780
The Philipines	296	399	399
India	1086	1598	2025
China	3200	3900	4400
Australia	732	807	807
New Zealand	92	92	92
Total	***15302***	***18880***	***20107***

**Projected*

Table: 8

Refining Capacity in India

(Fig in MMTPA)

	Refinery	*Capacity*
IOC	Guwahati	1.00
	Barauni	3.30
	Gujarat	9.50
	Haldia	2.75
	Mathura	7.50
	Digboi	0.50
HPCL	Bombay	5.50
	Visakhapatnam	4.50
BPCL	Bombay	6.0
MRL	Manali	6.50
	Narimanam	1.50
CRL	Cochin	7.50
BRPL	Bongaigaon	2.35
Total		***57.40***

Table 9

Proposed Expansion / Grassroot Refineries

Expansion:

Refinery	**Capacity**
Barauni	2.70
Gujarat	3.00
Haldia	1.00
Digboi	0.15
Vısakhapatnam	3.00
Total	***9.85***

Table : 10(i)

Proposed Expansion / Grassroot Refineries

Grassroot Refineries:

Refinery	*Capacity*
Panipat	6.0
Mangalore Refineries & Petrochemicals	3.0
Reliance Petroleum, Vadinar	15.0
Essar Oil, Vadinar	9.0
Numaligarh	3.0
Eastern India	6.0
Central India	6.0
Western India	6.0
Total	***54.0***

Table : 10(ii)

Proposed Expansion / Grassroot Refineries

Grassroot Refineries(Expected):

Refinery	*Capacity*
International Petro, Surat	5.0
AShok Leyland, Daitari	6.0
Black Gold Refinery, Visakhapatnam	2.9
Petrodyne, Karaikal	1.4
Jindal Ferro alloys Visakhapatnam	6.0
Port Moddy TIDCO Tuticurin	2.0
Aban Lyoyd Chiles Tuticurin	3.0
Seros Fund Management Haldia	6.0
Meplac Udyog, Gujarat	0.5

Table : 10(iii)

Product Quality Outlook in European Countries

MS

	1995	**1996**	**2000**	**2001**
Benzene, %v	5.0	3.0	3.0	1.0
Aromatics, %v	-	-	35	30
Olefins, %v	-	-	15	10
Sulphur, ppm	1000	500	200	100
RVP, kpa	s 70-80 w90-100	s70-80 w90-10	s62-80 w80-95	s62-70 w70-90
Oxygen Content Max. Min.	2 5-3 7 -	2 5-3.7 -	2 5-3 7 -	-- 2 0

Table: 11(i)

HSD

	1995	1996	2000	2001
Sulphur, %w	0.20	0.05	0.02	0.02
95% Recovery ,C	370	370	350	350-340
Cetane Index	46	46	48	50
Cetane No.	49	49	52	52
Aromatics, %v	-	30	25	25
P.C.A's %v	-	8	5	5

s: summer w: winter

Table: 11(ii)

Product Quality Outlook in European Countries

Sulphur in Residual fuels

	1995	1996	2000	2001
Jet A-1	0.3	0.20	0.10	0.05
Illuminating Kero	0.05-0.30	0 05-0.20	.03- 10	.01-.05
Heating Gasoil	0 20	0.20	0.10	0.05
Inland Fuel	1.0-4 0	0.8-3.5	0.8-2.0	0.5-1.5
Power Plant Fuel	1.0-3.0	0.8-3 0	0.8-2.5	0.5-1.5
Bunkers	4.3	4 3	3.5	2.5

Table : 11(iii)

BIS Specifications for MS

	Present	***Revised with immediate effect***	***Proposed for 2000 AD***
Density	Report	Report	0.70-0.75
Potential Gum g/m3 max.	-	50	50
Sulphur %w max.	0.25	0.20	0.10
RVP at 30C,kpa	70 max	35-70	35-60
Vaopr Lock Index Max. Summer Winter	 - -	 750 900	 750 900
Benzene %v max.	-	-	5.0
RON, Min	87 (ORD) 93 (PRE)	87 (ORD) 93 (PRE)	
AntiKnockIndex (RON+MON)/2		82 (ORD) 88 (PRE)	84 (ORD) 88 (PRE)
Lead content, g/l	0 56 (ORD) 0.80 (PRE)	0.56/0.013(ORD) 0 80 (PRE)	0.15/0.013(ORD) 0.01 (PRE)
Oxdation Stability minutes	360	-	-

Table: 12

BIS Specifications for HSD

	Present	*Revised with immediate effect*	*Proposed for 2000 AD*
Density	Report	Report	0.82-0.88
Cetane Number. Min.	42	45	48
Acidity, Total, max.	0.50	0.30	0.20
Carbon residue (on 10%) %max.	0.20 (On total)	0.35	0.30
Distillation: 95% Recovery			370
90% recovery	366	366	
85% recovery			350
Flash point, c	32	32	35
Kinematic viscosity cst at 40 degC	2.0-7.5	1.8-5.0	2.0-5.0
Total Sulphur, % max	1.0	1.0	0.25
Total Sediments (mg/100ml) max	1.0	1.60(UOP)	1.60(UOP)
Water content, %v max	0.05	-	-

Table: 13

Refining Upgrade Options

Naphtha Upgrading	Isomerisation Catalytic Reforming Petrochemical option
Distillate Upgrading	Desulpherisation
Vacuum Gasoil Upgrading	Vacuum Distillation Vacuum Gasoil Desulherisation FCCU Hydrocracking Lube oil base stocks
Residuum Upgrading	Visbreaking Solvent Deasphalting Delayed Coking Flexicoking Resid Catalytic Cracking Hydrotreating(Atm & Vacuum) Vacuum resid Hydrocracking Gasification/ Power Generation
Light Olefin Management	Alkylation Poly-Naphtha Etherification Petrochemicals Deep Catalytic Cracking

Table: 14

Comparison of Different processes for Residue Upgradation

	Non Catalytic	*Catalytic*	*Extrac-tion*	*Hydrogen Addition*
Simplicity	High	Med	Med	Low
Flexibility	Low	High	Low	High
Cost	Low	MED	MED	High
Products	Coke/FO	MS	DAO	MD/VGO
Quality of Products	Low	Med	Med	High
Resid Convn Level	Low-Med	Med	Med	High
Rejection as Fuel Oil	High	Med	Med	Med
Rejection as Coke	High	Med	Med	Med
No of Units in World	Large	Large	Avg	Avg
Recent Trend	Low	Med	Med	High
Environment pollution	High	Med	Nil	Low
On Stream Factor	Poor	Med	Med	Hugh
Problems	Coke Disposal	Heavy Residue	High Energy	Hydrogen Req.

Table : 15

Performance Comparison of Resid Upgradation Process Combination

(5.0 MMTPA Unit)

	FCC+ DC	***HC+DCA***	***RHT+RCC***	***FCC+SDA***
LPG	7.9	5.7	6.6	6.0
Gasoline	48.5	24.1	50.9	40.8
Jet Fuels	4.3	13.3	3.5	6.5
Diesel	29.2	41.3	34.7	28.9
Pitch, Coke, FO	10.9	15.5	4.3	15.5
Relative Margins	1.6	1.0	1.63	1.08
Relative Investment	1.23	1.0	1.75	1.06
Rate of Return	28.9	22.4	20.6	22.9

Table : 16

Optimum Process Configuration

FCCU + Delayed Coker:

- Medium Investment & High Return
- Max. Gasoline
- Coke Disposal

Hydrocracker + Solvent Deasphalting Unit:

- Low Investment & Moderate Returns
- Max. Middle Distillates
- Pitch Disposal

FCCU + Solvent Deasphalting Unit:

- Low Investment & Low Returns
- Max. Gasoline
- Pitch Disposal

Resid Hydrotreating + Resid Cat Cracking

- High Investment & Low Returns
- Least Unwanted Products
- Max. Gasoline

FCCU + Delayed Coker

- Low Investment
- Most Attractive if Crude is light & VGO Hydro treating can be avoided
- Max. Distillate
- Needle Coke Production

Table : 17

INDIAN REFINING : A FOREIGN INVESTORS PERSPECTIVE

MR EVERETT LEWIS
Refinery Project Executive
Oman Oil Company Inc
Houston, USA

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR EVERETT LEWIS
Refinery Project Executive, Oman Oil Co Inc
Houston, USA

25 years in the refining industry, with BS Chem E, MBA, experience includes Chevron USA, Pacific Resources Inc (independent refiner marketer) and BHP Australia, with assignments in engineering, refinery operations, marine transportation, terminalling, pipelines, planning, supply trading, project development, and international joint ventures. Positions held include Refinery Manager, VP Manufacturing and VP Supply and Trading.

HOW INTERNATIONAL INVESTORS VIEW INDIAN REFINING & MARKETING EQUITIES IN A REGIONAL CONTEXT

MR LARS REIERSON
Equity Research Analyst
Morgan Stanley & Co
Singapore

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR LARS REIERSON
Energy Research Analyst, Morgan Stanley & Company
Singapore

Lars Reierson is Morgan Stanley's Senior Asia-Pacific Energy Research Analyst, and operates out of Singapore Lars received both his BA and MA from Harvard University in Middle Eastern studies and Economics After working in energy corporate finance for two years, he moved to energy research, where he has been for six years Lars has covered the major oil and R & M companies in both New York and London before his current assignment

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL VI

DOMESTIC MARKETING IN INDIA

PANEL CHAIRMAN :

MR RAJENDRA SINGH
Chairman & Managing Director
National Thermal Power Corporation (NTPC)
New Delhi, India

PANELLISTS :

MR VIKRAM SINGH MEHTA
Managing Director
Bharat Shell Limited
(a joint venture between Bharat Petroleum Corp
& Shell Overseas Investments B V)
Bombay, India

MR O N MARWAHA
Executive Director (LPG)
Indian Oil Corporation Ltd.
New Delhi, India

MR A P CHAUDHRI
Executive Director
Centre for High Technology
New Delhi, India

MR PETER M ROBERTS
Project Executive, Oman India Pipeline
Oman Oil Company Inc.
Houston, USA

RAJENDRA SINGH
Chairman and Managing Director,
National Thermal Power Corporation Ltd. (NTPC),
New Delhi, India

The First Annual
Indian Oil & Gas Conference
September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR RAJENDRA SINGH
Chairman and Managing Director, National Thermal Corporation Ltd (NTPC)
New Delhi, India

NTPC the largest power utility in India with an installed capacity of 15625 MW(12450 MW Coal+3175 MW Gas) contributed about 30% of thermal power generation in the country The Company's estimated profit during 1994-95 is Rs 1112 crores with a turnover of Rs 6373 crores The generation by NTPC Stations during 1994-95 has been 79 09 billion units at a PLF of 76 57% The company added 1096 MW of capacity in 1994-95 which is 24% of the total capacity additions in the country For the year 1993-94, NTPC is again rated as EXCELLENT for exceeding all the targets set under the MOU For the year 1994-95 also, NTPC has exceeded all the performance targets set under the MOU

The approved cost of the projects is the order of Rs 24,560 71 crores The Company employs about 22 000 employees in various disciplines It is the largest single beneficiary (US$ 3713 million) of the World Bank assistance and NTPC projects are also financed by a number of bilateral credits The Company is continuing to play the lead role in the capacity addition in the country

Shri Rajendra Singh started his career with the Indian Oil Corp Ltd in 1964 After 13 years in Engineering and Marketing he joined Engineers India Ltd In May 1988, he joined NTPC as Director (Personnel) He took over as Chairman & Managing Director of this megapower utility in June 1992

Has successfully negotiated the first tranche of US$400 million of the US$1 2 billion loan with the World Bank and with the Asian Development Bank for change on implementing agency from UPRVUN to NTPC and the transfer of US$160 million loan for Stage II of Feroz Gandhi Unchahar STPP Shri Singh is currently spearheading the rapid expansion programme of the Company, and by adopting multipronged approach he is now steering the Company to reach a capacity of 25,000+ by the year 2002

The Company is also expanding its operations internationally, and has bagged two major overseas contracts (i) one from Nepal Electricity Authority for supply and construction of 132kV, 66kV and 33kV substations funded by ADB at a contract value of approx Rs 19 06 crores, and (ii) second from Dubai Electricity & Water Electricity Authority for the construction of 2 Nos 132kV Indoor Sub-Station at a contact value of approx US$12 2 million

As an engineer by profession Shri Singh is well known in the field of Management Has presented several papers in national and international seminars Takes active interest in Academics-Industry interface He represents several national level professional bodies Is also the president of the All India Management Association, national APEX body recognised by the Government of India for promotion of professional management in the country Is a member of Bureau of Indian Standards, National Environment Council, Technology Information, Forecasting & Assessment Council, Development Council for Heavy Electrical and Allied Industries Is also a member of the Governing Council of the Indian Council of Arbitration, Fellow Member and Executive Council Member of the Institute of Directors, Faculty of Management Studies University of Delhi and Member of the All India Board of Undergraduate Studies in Engineering & Technology of AICH and School of Management, India Gandhi National Open University
He has widely travelled and his sojourns have taken him to the USA and many countries in Europe, the Middle East and the Far East

LUBRICANTS MARKETING : THE CHALLENGES AHEAD

MR VIKRAM SINGH MEHTA
Managing Director
Bharat Shell Limited
(a joint venture between Bharat Petroleum Corporation & Shell Overseas Investments B V)
Bombay, India

Paper to be distributed separately

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR VIKRAM SINGH MEHTA
Managing Director, Bharat Shell Ltd (a joint venture between
Bharat Petroleum Corp & Shell Overseas Investments B V)
Bombay, India

Date of Birth	October 30 1952
Marital Status	Married, 2 daughters

Professional Qualifications

1 B A Mathematics, Delhi University, India
2 B A Economics, Oxford University, UK
3 M A , Energy Economics, Fletcher School, Tufts and Harvard University USA

Member of various professional bodies including the Institute of Petroleum
Author of several articles on Petroleum and Energy related issues

Professional Career

1976 - 80
Academics and Government Service (including a 2-year stint with the Indian Administrative Service)

1980 - 84
Philips Petroleum Company, U K and U S A

1984 - 88
Strategic and Corporate Planning Advisor, Oil India Ltd and Ministry of Petroleum Government of India

1988 - 91
Shell International, London, Board Director of Pakistan Burmah Shell, Shell Markets Middle East, Saslubco, Joslac, Shell Co of India and other companies in the Middle East South Asia

1991 - 92
Managing Director, Shell Markets Egypt and Shell Chemicals Overseas, Egypt

1993
Managing Director Shell Group of Companies in India

- Bharat Shell Ltd a Joint Venture between Bharat Petroleum Corp & Shell Overseas Investments B V (Manufacturing & Marketing)
- Shell Company of Thailand
- Shell India Petroleum Development (Exploration)

LPG : SUPPLY, DEMAND & INFRASTRUCTURE 1995 - 2005

MR O N MARWAHA
Executive Director (LPG)
Indian Oil Corporation Limited
New Delhi, India

1.0 INTRODUCTION

I am pleased to present a paper on LPG : Supply, Demand and Infrastructure 1995 -2005. I would like to thank Dr F Fesharaki and Dr R K Pachauri Conference Co-Chairman IOGC 1995 for giving an opportunity to present this paper to this august audience. I would also like to thank personally Ms Vimla Mulchand for inviting me to this conference.

With the kind permission of the panel Chairman Mr Rajendra Singh, before proceeding with the presentation I will give a brief overview about Indian Oil Corporation Ltd, where I am employed as Executive Director(LPG).

I am delighted to inform you that Indian Oil Corporation Ltd is the only Indian company listed in the Fortune 500 listing of mega corporations. Indian Oil registered a turn over of US $ 9640 million during 1994-95(April-March) and profit after tax of US $ 340 million.

It is the largest petroleum refining and marketing company in India with a market participation of 55.3 %. It sold 36.25 million tonnes of petroleum products during 1994-95. Indian Oil operates 6 refineries with a refining capacity of 24.4 million tonnes and during 1994-95 refined 25.16 million tonnes of crude oil registering a capacity utilization of 103 %. It has a pipeline network of 3850 KMs and transported 24.47 million tonnes of petroleum products during 1994-95. It has 36 oil terminals, 117 oil depots, 94 Aviation Fuelling Stations and three lube blending plants with a capacity of about 415 TMT. It has retail network of 6284 outlets for petrol and diesel and 3284 agencies for Kerosene.

Coming to LPG Marketing, Indian Oil sold 1.78 million metric tonnes with a market share of 51.8 % during 1994-95. It has a customer population of 12 million serviced by 2418 distributors as of end March 1995 in 1178 towns. It has bottling capacity of 1.2 million metric tonnes per annum. Its future plans include commissioning of LPG import terminal of 0.6 million metric tonnes at Kandla on west coast of India and setting up of LPG terminals at Haldia in East and Ennore and Kakinada in South in the Eastern coast.

2.0 HISTORY OF LPG MARKETING IN INDIA

2.1 LPG marketing was started in India in 1950's when the then Burmah Shell and Stanvac companies started the production and marketing of LPG at their Refineries in Trombay. Since it was a new product, efforts were made for promoting the use of LPG and the marketing of LPG was entrusted to private concessionaires. After coming of the foreign oil companies into the public sector fold in mid-1970's, marketing network of the concessionaires was taken over by the companies concerned. In the beginning, the demand of LPG in the market was sluggish but showed increase in growth in 1980's after the product proved its acceptance and popularity as domestic cooking fuel. The sale of this product in 1970-71 (April-March) was only 176 Thousand Metric Tonnes (TMT) which increased to 405 TMT in 1980-81 and in the year 1994-95 the sales have increased to 3436 TMT.

2.2 The growth in LPG demand being sluggish till early 1970's, the marketing companies had adopted promotional strategies for increasing the consumption of LPG by way of free demonstration and free-home delivery. As the demand picked up and the waiting list started building up, from around mid-1970's, the marketing companies started planning and marketing of LPG. As new sources of production started coming up, the Oil companies started planning and marketing of LPG in Phases. The Phase represents period of time by which detailed plans were chalked out for developing necessary infrastructure for expansion of LPG marketing including the setting up of distributor network. Phase-I to Phase-IV was concerning the period between 1979 to 1990. Phase-V (VIII Plan) Marketing Plan was approved by Ministry of Petroleum & Natural Gas covering the period 1990-97.

2.3 Presently, the Oil companies have set up distributors' network in 1741 towns in the country covering a population of about 125 million out of the total population of 900 million.

3.0 LPG DEMAND IN INDIA

3.1 In India, LPG is marketed both in bulk and packed conditions as indicated below

i. Industrial/Commercial - Bulk
ii. Domestic/Commercial - Packed

3.2 In 1994-95, a total of 3.5 million MTs of LPG has been consumed. Break up of this LPG consumed in various sectors in 1994-95 is indicated below:

i.	Domestic (Packed)	3.2 Million MTs
ii.	Commercial (Packed)	0.1 Million MTs
iii.	Industrial/Commercial (Bulk)	0.2 Million MTs
	Total	3.5 Million MTs

3.3 Till recently, the marketing of LPG was done in India by the Public Sector Oil Companies, both to the domestic as well as to commercial/industrial customers.

There are 23 million customers as of end March'95 using LPG in the country. The supply of LPG is done through cylinders bottled in about 82 bottling plants with achievable capacity of more than 3.5 million tonnes per annum. The customers are serviced all over India through a network of about 4500 distributors. The cylinders after being bottled are transported by road through trucks to various distributors who in turn supply the cylinders to the ultimate consumers in their house-holds. In order to ensure that the customers have continuity in supply of gas in the kitchen, a second cylinder is offered to them. Presently, 55% of the LPG customer population are having second cylinder. In this process, the inventory of the gas which is required to be held by the Oil companies is partly held by the customers.

3.4 The annual average compound growth rate of consumption of LPG in the country is about 13% p.a. for the last 15 years. Initially the LPG marketed and consumed in the country was available only from the Refineries. Later on, fractionator plants were set up to fractionate LPG from the associated gas which revolutionized the availability of LPG in the country and has given a boost to the demand in the country. Presently, the gap between the indigenous availability and the present requirement of LPG for feeding 23 million customers is bridged through imports. The break up of the production and the imports is given below:

(A)	Indigenous Production	Quantity (TMTs)	Share (%)
	(i) Refineries	1426	41.4
	(ii) Fractionator Units	1423	41.3
	Sub-Total	2849	82.7
(B)	Imports	594	17.3
	Grand Total	3443	100.0

3.5 It will be seen that 17% of the present consumers' requirement is being met through imports while the fractionator units are contributing 41% of the total LPG requirement.

4.0 MARKETING PATTERN OF LPG

4.1 Presently, 90% of LPG in India is consumed in the domestic sector for cooking and heating purposes. A beginning has made in certain parts of the country for using LPG for lighting. The balance 10% is consumed in commercial and industrial sectors. In the commercial sector, LPG is presently used in restaurants, hotels, canteens, road-side eating houses mainly for cooking and heating. The use of LPG in Commercial Sector, till recently was regulated by the Government of India.

4.2 Use of LPG in industrial sector has so far been regulated through the allocations made by Govt. of India based on the technological necessities assessed by Director General of Technical Development (DGTD). Presently, LPG is consumed in the following industrial applications.

- Ceramic Industry for producing the impermeable glaze.
- Glass Industry for processing of glass, edge cutting, flame polishing and annealing
- LPG is used as a feedstock in the petrochemical industry
- Baking and confectionery industries for making bread, cakes, chocolates and biscuits
- Printing Industry for drying the ink
- Engineering industry for hardening of metals.
- Beverages industry or drying and seasoning of tea leaves
- Textile industry
- Food industry
- Ship Breaking industry

However, with the advent of free marketing of LPG in the country, there is going to be spurt in the demand of LPG in the above sectors.

4.3 In addition, there is considerable scope in introducing the usage of LPG in the following untapped sectors:

- As an Automotive Fuel
- Food industry for meat processing, to dry fish, etc
- Carbonated Beverages for producing carbon-di-oxide
- Brick kilns for manufacturing of bricks
- Use of LPG as an aerosol propellant
- Poultry Farm
- Agricultural Sector
- Refrigeration and air-conditioning in domestic households
- Laundries and dry cleaning
- Swimming Pool for water heating.

4.4 The pattern of the cooking fuels used in urban households will indicate the scope available for marketing LPG in the country. The details are given below:

LPG	..	26.9%
Kerosene	..	23.6%
Firewood	..	32.7%
Others	..	16.8%
Total		100.0%

While firewood occupies a predominant position on overall basis, LPG is gradually replacing other cooking fuels.

4.5 Composition of cooking fuels, used in rural areas indicates that firewood is predominantly used for cooking purposes, as given below:

Firewood	..	71.7%
Kerosene	..	1.3%
LPG	..	1.2%
Animal Dung	..	19.6%
Others	..	6.2%
Total		100.0%

A large potential exists for introducing LPG in rural areas to substitute other cooking fuels depending upon retail distribution in the markets.

5.0 CONSUMPTION PATTERN OF LPG IN DIFFERENT PARTS IN INDIA

5.1 The LPG consumption pattern is not uniform in the country. It is varying on account of socio-economic conditions prevailing in various parts. The data below is useful to know the consumption pattern in different parts of the country for planning any marketing activity:

Region	Per Capita Consumption* (in Kgs.)	%age Share of Consumption of Region on All India
North	156	32.7
East	141	11.1
West	141	31.9
South	137	24.3
All India	145	100.0

* Per Capita Consumption is derived by dividing total sale in the zone with the total number of effective consumers.

5.2 The consumption of LPG in the Northern and Western India is higher compared to Southern and Eastern parts. However, the demand in Northern and Western India is also unsaturated. The consumption in Eastern Sector is low on account of socio economic factors and is bound to increase with the change in the social and economic conditions as a result of economic development taking place due to liberalization in the economy.

5.3 Apart from different consumption pattern in different parts of the country, the consumption pattern in different seasons is sharply varying within the Region itself. The highest variation is in the Northern part of India where the consumption goes up by 25% in the winter season compared to the summer months. The data given below reveals interesting scene in the consumption pattern in different Regions in different seasons.

Region	Per Capita Consumption (in Kgs.)			
	Apr-June	July-Sept	Oct-Dec	Jan-Mar
North	33.5	36.7	41.7	44.1
East	31.6	34.7	36.5	38.2
West	30.7	34.8	36.5	39.0
South	30.4	34.0	36.2	36.4
All India	31.8	35.1	38.1	40.0

5.4 While making the marketing plans, therefore, care needs to be taken of the peak/low demands in the different seasons in the different parts of the country. Marketing infrastructure, therefore, is planned to cater to the above variation.

6.0 POTENTIAL CONSUMPTION/DEMAND

6.1 The consumption pattern of LPG in India has been allowed to grow to the extent of the indigenous production and restricted import facilities. As stated above, initially, LPG was available from the Refineries. With the setting up of the fractionator plants on the discovery of natural gas particularly in the Western Sector, the LPG availability increased considerably leading to a spurt in the LPG consumption in the country. The demand of LPG started building up leading to large waiting list of the consumers, on account of restricted availability of the product. The present consumption is, therefore, cannot represent as the realistic demand potential.

6.2 Oil Industry had commissioned a market research study in 1991 by the Indian market Research Bureau (IMRB) a leading market research company in India to assess the potential LPG demand in the country till the year 2000. The study was done only in urban markets. The urban markets were classified based on the following criteria as per the Government of India Census document.

a) All statutory towns, i.e. all places with a Municipal Corporation, Municipal Board, Cantonment Board or notified town area etc.

b) All other places which satisfy the following criteria:

i. a minimum population of 5000.

ii. 75% of male working population engaged in non-agricultural (and allied) activity; and

iii. a density of population of at least 400 per Square Kilometers (or 1000 per Square Mile).

The study, therefore, covered the current users of LPG and non-users of LPG in town where LPG is marketed as well as in towns where LPG is not marketed. The total sample of 22145 house-holds were contacted in 166 towns. The study also included commercial customers where there is a scope of using LPG for cooking and heating purposes.

6.3 Based on the survey results, IMRB estimated that LPG is being used by 37% of the urban households. 6% of the households have already registered for new LPG connections, with the oil industry. 14% of the households are ready to use LPG if available, who have not registered with the oil industry. Hence, a total of 57% of the urban households are potential customers of LPG. Based on this and taking into account the projected population and income growth, IMRB have estimated the LPG demand at 7.8 million MTs in the year 2000.

6.4 In addition to survey by the Oil Industry through the IMRB, Ministry of Petroleum and Natural Gas, Government of India, set up an Oil Industry group in March'94 to assess the LPG demand in the country till 2007. The Industry group assessed the demand keeping in view the IMRB field survey and Co-relation Model between the growth in the urban population and consumption pattern. The Industry group worked out the demand levels keeping in view the increase in urban house-holds upto 2007. No scientific study has been done in assessing the demand of commercial, industrial and rural sectors. However, the Industry group assessed the demand for commercial and industrial sectors assuming the growth of 10% of the existing level of demand. The final assessment of demand as presented to MOP&NG by Industry group is as follows

(Figures in TMTs)

Year	Domestic	Non-Domestic	Bulk	Rural	Total
1995-96	3199	150	330	-	3679
1996-97	3414	200	362	-	3976
1999-00	4976	500	483	176	6135
2001-02	6120	700	591	299	7710
2006-07	8006	1000	1042	619	10667

The group has also recommended the year-wise LPG enrolment plan of new customers. Based on this enrolment plan, LPG will be made available to 65% of the urban households by 2000 and 77% by 2007 as against the present 48% of urban households being covered.

I would like to add that the above demand potential is the demand which will be met by Public Sector units. There is an additional demand of about 2.0 million tonnes for marketing by private sector. In this paper, we have addressed the infrastructure required to meet the Public Sector demand potential.

7.0 SUPPLY DEMAND BALANCE

7.1 Based on the above consumption pattern, the supply-demand balance indicate huge shortfall in the indigenous availability. The demand of LPG in India is much more than indigenous availability. Presently, about 17% of LPG demand is met from imports. In future, dependency on LPG imports is going to increase tremendously as the indigenous availability is growing at much lesser rate than the demand. With the advent of LPG marketing by the private sector, imports are envisaged by the private parties for marketing LPG independent of the public sector channels.

7.2 A supply demand balance of LPG for the selected years upto 2006-07 is given below based on the Oil Industry demand estimates:

Figs in TMT

	95-96	96-97	99-00	2001-02	2006-07
Demand	3679	3976	6135	7710	10667
Indigenous Availability	2685	3015	4628	5031	5031
Shortfall	994	961	1507	2679	5636

The indigenous production is based on the latest estimates available with Oil Coordination Committee, New Delhi. The production is from Public Sector Refineries, Public Sector Fractionators and Joint Venture Refineries identified in the VIII Plan.

It is seen from the above that the shortfall is increasing from 994 TMTs in 1995-96 to 2679 TMTs in 2001-02 and 5636 TMTs in 2006-07. The dependence on imports will increase from 17% to about 53% of the demand. Oil industry in India is setting up mega size import facilities to take care of the huge imports anticipated in the coming years.

7.3 Presently, LPG is imported in India at two ports, namely Bombay and Vizag. In Bombay, LPG is imported at the Pirpau jetty. This jetty is used for LPG, Lube base stock, chemicals, etc. Ships are berthed based on queuing system. No priority is given for LPG tankers. It is possible to unload tankers of about 5 TMT in about 48 hours. As the jetty is always used, it is very difficult to unload more than 5 to 6 tankers in a month. The total capacity for imports can be taken as about 300 TMT per annum (TMTPA).

7.4 In Vizag port, a separate berth is available for unloading of LPG. This berth is used only on weekends due to safety reasons. It is possible to unload about 8 TMT in about 60 hours. By taking into account about 4 weekends per month, it is possible to import about 360 TMTPA.

7.5 The total imports from existing facilities is about 660 TMTPA.

7.6 Public Sector oil industry are setting up mega size import facilities to import 600 TMTPA each at Kandla by IOC and at Mangalore by HPC. These two projects will greatly enhance the availability of LPG.

7.7 The state of art facilities are being developed at this two locations. At Kandla, refrigerated LPG will be stored in cryogenic state. All the allied facilities like pipeline, pumps, valves, etc will be handle the refrigerated LPG.

8.0 INFRASTRUCTURE FACILITIES

The infrastructure facilities required for marketing of LPG can be broadly divided into the following groups:

- Import Facilities
- Storage Facilities
- Transportation Facilities for moving bulk
- Bottling Facilities
- Distributor Network
- Equipment Manufacturing Capacities

8.1 Import Facilities

It has already been pointed out that presently, in India the facilities to import LPG are available at Bombay and Vizag. Both locations put together, it is possible to import about 660 TMT per annum.

IOC and HPC are setting huge import facilities to import 600 TMTPA each at Kandla and Mangalore. It is expected that these facilities will be available for imports from middle of 1996-97.

Vizag Port Trust is setting up an exclusive terminal for import of LPG in the outer harbour. The facilities include a new LPG berth for unloading of LPG and a pipeline to transfer LPG directly from ship to HPCL refinery storage tanks. It is expected that these facilities should be available by 1997. With the commissioning of these facilities, the new LPG terminal can handle LPG imports of 1.0 million tonnes per year.

With the above facilities, it will be possible to import about 2 to 2.5 million tonnes per annum from Vizag, Kandla, Mangalore and Bombay. There are also plans by Public Sector undertakings to set up new import facilities of 0.6 million tonnes at Hadlia, Nhava Sheva, Okha, Ennore and Kakinada.

Ministry of Petroleum and Natural Gas had appointed a committee to identify new ports for import of LPG. The committee had identified a number of locations which include Sikka(Gujarat), Okha(Gujarat), Porbunder (Gujarat), Hazira(Gujarat), Pipavav(Gujarat), Ratnagiri(Maharashtra), Goa in the west coast and Paradip(Orissa), Gopalpur(Orissa), Kakinada (Andhra Pradesh), Tuticorin(Tamil Nadu) in the east coast.

Facilities at the following ports are being set up by the Private Sector:

Figs in MMT

Name of the company	Port	Capacity
1.SPIC,Madras	Tuticorin	0.1
2.GSFC, Baroda	Sikka	0.1
3.Hindustan Aegis	Bombay	0.2
4.Shri Shakti	Kakinada	0.2
5.Dharamsee Morarji	Navlakhi	0.2
6.Pal Refineries	Paradeep	0.1
7.Peevses	Calicut	0.1
8.Western India	Pirpav	0.2
9.Essar	Hazira	0.1
10.Reliance	Hazira	0.1
11.Feena Petro	Cuddalore	0.1
12.Maharashtra Organo	Goa	0.1
TOTAL		1.6

If all the above ports are utilized then it will be possible to import about 1.5 million tonnes of LPG per year by the end of the century.

8.2 Storage Facilities

Presently, Public Sector Units have a total tankage of about 202 TMT. At a capacity utilization of about 80 %, it is possible to store about 162 TMT. With the annual demand of 3.7 million tonnes during 1995-96, the tankage cover works out to about 16 days. This is on a very low side and if any disruption in the production or transportation takes place backlog in delivery of LPG refills in the domestic sector starts immediately.

From the above, it can be observed that the oil industry will require huge storage facilities in the future. The world over especially in Western Europe, the storage of LPG is discouraged in conventional storage tanks like spheres and bullets. The main reason for this shift is the safety considerations and non availability of land. The failure of these storage facilities is on account of metal fatigue, due to uneven settlement of foundations and fear that explosion could cause wide spread damage due to metal pieces flying over a large area.

On account of above considerations, the oil industry is planning to set up storage tanks based on new technologies. IOC is setting up cryogenic storage facilities at Kandla. There are also plans to set up mounded and underground storage. The various types of underground storage are disused mines, leached cavities, aquifers and mined caverns.

8.3 Transportation Facilities for moving bulk:

Presently, in India bulk LPG is moved by either rail or road. About 80 % of the bulk movement is by road. By 2001-02, the industry has to move about 6 million tonnes of LPG. If industry moves 100 % of LPG by rail to all rail fed bottling plants, then industry will require a total of about 1500 tank wagons. Industry is having 619 tankwagons and have already placed orders with the railways for 262 tankwagons. Taking this into consideration, industry will require further 660 tank wagons by 2001-02.

In addition, industry will require an additional 4000 tank trucks to move LPG by road to road fed bottling plants by 2001-02.

Industry is also planning the 'Hub and Spoke' concept for moving bulk LPG. As per this concept, LPG is moved by rail from production sources to bottling plants having rail unloading facilities or set up tank farms with rail unloading facilities. From the bottling plants/tank farms transport the LPG by road. Based on this concept, the industry will be requiring additional 1268 tank wagons by 2001-02.

However, the capacity to manufacture LPG tank wagons in the country is very limited. Presently, about 100/125 wagons can be manufactured in the country. As such the induction of full fleet of wagons is not possible. Road transport will continue to play a significant role in the movement of LPG.

To take care of safety aspects, LPG tank trucks are designed and fabricated under Static and Mobile Pressure Vessels (Unfired) Rules 1981 duly licensed by Chief Controller of Explosives. These rules ensure to have all the necessary safety fittings and accessories for tank trucks. In addition, Indian Oil Corporation also trains the tank truck crew on defensive and advanced driving skills and product safety. Refresher training are also conducted for experienced drivers. A certificate is issued after the completion of training by IOC.

IOC has also identified routes from production sources to bottling plants for movement of bulk trucks. These routes are given in the form of 'Route Maps'. The 'Route Maps' takes care to see that the trucks are using the national and state highways and to avoid district and other roads. The route takes the bypasses where available to avoid entry in cities/towns. While identifying the routes it is also ascertained whether the bridges and culverts falling on these routes can take the heavy loads of tank trucks.

In the 'Route Maps' halting points are identified which are away from crowded and road side eating places where fire sources are available. Halting points are normally the retail outlets of Indian Oil Corporation Ltd.

In the event of accident, Indian Oil has designed and developed 'Emergency Response Vehicles' to give assistance at the spot of accident.

8.4 Bottling Facilities

Presently, industry has an installed bottling capacity of about 3.2 million tonnes per annum. At the end of VIII Plan, industry will have a bottling capacity of 4.4 million tonnes per annum. To meet the demand of packed LPG, industry has to set up about 2.5 million tonnes of additional bottling capacity during the IX Plan period.

The LPG storage tanks are designed with all the necessary safety features. The safety features include safety relief valves, excess flow check valves and remote operated valves. It includes emergency shutdown systems and auto sprinkler cover.

The entire filling system is bonded and earthed. Gas detection and vapour extraction systems are built in features of the bottling plants. Safety Committees are formed in all Indian Oil plants. Monthly fire drill and annually emergency response drill are conducted in all the plants. A ready made on-site and off-site emergency plan is developed to take care of emergencies.

8.5 Distributor Network

Presently, oil industry is having 4673 LPG distributorships spread through out the length and breadth of the country. To cater to the additional LPG demand, by 2001-02, industry will require an additional 435 distributorships in addition to the 1577 dsitributorships already planned in the 1993-94 and 1994-96 Marketing Plans. Thus a total of 6685 distributorships will be required to meet the demand of LPG during 2001-02.

8.6 Equipment Manufacturing Capacities

As you are aware, for marketing of LPG in packed the following equipments are required:

- cylinders
- valves
- pressure regulators

With the increased availability of LPG from the indigenous sources and new import locations, industry is planning to enrol about 4 million new customers per year from 1996-97 to 2001-02. In the recent past, the maximum enrolment done by the industry was 2.3 million customers during 1994-95. Industry is also planning to ensure that all the customers are offered a second cylinder for uninterrupted supplies of LPG to households.

The cylinders required for enrolling of new customers and second cylinders will be of the order of about 9.6 million cylinders. Presently, the cylinder manufacturing capacity in the country is about 6 million cylinders per year on a single shift basis. If the units operate on two shifts, it will be possible to produce about 12 million cylinders. Hence, it should not be problem to take care of the cylinder requirements by the existing manufacturers.

Industry will require about 10 million valves every year. It is expected that the industry will be able to procure these valves without much problem.

As there is a shortage in the manufacturing capacity of pressure regulators, Ministry has already decided to induct more manufacturers based on industry's recommendation. The industry will be requiring about 4 to 5 million pressure regulators per year.

9.0 CONCLUSION

To conclude, there is a vast potential for future investments in the LPG Marketing infrastructure. On account of dependence on imports of the order of about 2 to 3 million tonnes, the pay off will be very attractive.

It is felt that one of the following options can be thought of for investment in the LPG Marketing infrastructure:

9.1 There can be a joint venture between Public Sector and Private sector for setting up of LPG import terminals. The facilities can be used for import of LPG to be marketed by Public Sector units.

9.2 Private Sector can set up LPG import facilities and lease it to Public sector for importing LPG.

9.3 Private Sector to set up LPG import facilities and market LPG in bulk.

9.4 Private Sector to set up LPG Import and bottling facilities and lease it to Public sector for marketing of packed LPG.

Any of the above options can be explored, for future investments.

To conclude Ladies and Gentlemen, you might have seen there is a vast scope for demand potential in India which will touch about 10.7 million tonnes by 2006-07. The demand from domestic sector will be about 8.0 million tonnes covering 77 % of the urban population. There is a vast scope of demand in the commercial and industrial sectors. The demand from commercial/industrial will be of the order of about 2.0 million tonnes. In lighter vein if it is assumed that average size of Indian family consist of 5 numbers, India needs 180 million LPG connections and so far only 23 million LPG connections have been given. Such is the potential in the domestic sector. In the end, I will say that India is a great market for LPG.

I take this opportunity to thank The Conference Connection of Singapore and Tata Energy Research Institute, India for inviting me to present a paper in this conference.

ENVIRONMENTAL ISSUES AND PRODUCT SPECIFICATION CHANGES

MR A P CHAUDHRI
Executive Director
Centre for High Technology
New Delhi, India

ENVIRONMENTAL ISSUES AND PRODUCT SPECIFICATION CHANGES

INTRODUCTION

Since the dawn of civilisation, man has always been in search of improved forms of energy to upgrade his quality of life. Economic development has been associated everywhere both with qualitative and quantitative use of energy. The structural qualitative changes involved a switch from traditional non-commercial fuels like wood, agro-waste etc. to commercial fuels viz coal, petroleum, natural gas and of course electricity. Over the years, there has been a steady increase in the energy consumption world-wide and the contribution of petroleum in meeting the energy demand is very significant Today, 40 % of the world energy needs is met by petroleum products.

Petroleum has been called "Black Gold", and no precious metal can match the infinitely varied uses of petroleum. The modern petroleum industry dates back to the year 1859, when the first commercial well was drilled in Pennsylvania, USA The full potential of petroleum was unknown then and many refineries distilled crude oil for kerosene for illumination purposes discarding what remained in the stills. Since then, many of its uses were recognised and petroleum began to replace coal as the main source of energy. With the development of automobile industry, and industrialisation all around, the demand for petroleum products started growing very rapidly. From a thimbleful production of 34 litres a day from the first commercial well, the world petroleum production today stands at a mindboggling level of over 3160 million tonnes per annum (MMTPA)

The phenomenal growth of petroleum is not surprising, considering that petroleum products like gasoline, diesel and fuel oil provide a cheap and convenient source of energy The transport sector, throughout the world, almost entirely depends on oil Oil is also the principal source of feedstock for production of petrochemicals

Petroleum is expected to remain the world's largest single energy source for quite some time to come because of its many inherent advantages like .

- it is reasonably priced
- easily transported & stored and
- can be readily converted to transportation fuels

Petroleum plays such a dominant role in today's world that the extent of its use and the pattern of oil consumption indicate the degree of economic development of a country

The per-capita consumption of petroleum in India is amongst the lowest in the world However, the rapid industrial, technological and economic growth since the last few decades has brought in its wake significant increase in total energy requirements of the country As a result, the demand for petroleum products in India is growing at a much faster rate than the developed countries The demand of petroleum products which was a minuscule 2 7 MMTPA at the time of independence in 1947, has grown to a level of about 64 MMTPA today With the projected growth rate of 6-7 %, the demand is expected to reach a level of 100 MMTPA by the turn

ABSTRACT

World-wide, the environmental pollution associated with growing consumption of petroleum products has become a subject of primary concern today. The deteriorating urban environment, particularly in the major cities of developed and developing countries is primarily attributed to the rapid proliferation of automobiles and the increasing vehicular emissions associated with this As a result, upgrading the quality of transport fuels i.e. gasoline and diesel has drawn greater attention compared to any other petroleum product.

In India, the first major fuel quality change related to the lead phase-down in respect of gasoline Supply of low lead gasoline (0 15gm/lit) to the four metropolitan cities has been in force since June 1994 Present level of lead content in gasoline for rest of the country is 0 56 gm/lit and it is proposed to introduce low lead gasoline (0 15 gm/lit) throughout the country by December 1996 Unleaded gasoline, which is currently being supplied since 1 4 1995 only to the four metros for the new cars fitted with catalytic converters, will also be made available to rest of the country by 1999-2000 As regards quality upgradation of diesel, in the first phase, the sulphur content of diesel supplies to the four metros, which is at present 1 0 % wt max , will be restricted to 0 5 % wt max effective from 1.4 1996 By 1 4 1999, the sulphur content of diesel for supplies to the entire country will be brought down to 0 25 % wt max In addition to above, revisions to some of the critical parameters of gasoline and diesel are also under review All these will pose tremendous challenge to the Indian refining industry

This paper after analysing the primary causes for increasing vehicular pollution in India, highlights some of the proposed revisions in the quality parameters of gasoline and diesel, the impact of these changes on the refinery operations and the actions planned by the refining industry to effectively participate in combating vehicular pollution in the country.

of the century and to about 150 MMTPA by the year 2010-11 The demand profile of petroleum products in India is given in Annexure 1.

Today, there are 13 operating refineries in the country, all under the public sector, with a total refining capacity of 56.5 MMTPA In order to meet the explosive growth in consumption of petroleum products, India's refining sector has been opened up to private enterprises under the current economic reforms programme of the Government, and number of grassroots refineries are proposed to be set-up for creating additional refining capacity of about 75 MMTPA by the year 2010 With these developments, India is fast emerging as one of the key players in the hydrocarbon sector of Asia-Pacific region.

One distinctive feature in the demand pattern of petroleum products in India compared to the developed countries like US and Europe, is the very high demand for middle distillates particularly, diesel Also, the relative demand of gasoline with respect to diesel is significantly low compared to the developed countries. Consequently, the refinery operations in India are oriented towards maximisation of middle distillates (kerosene and diesel) as against gasoline maximisation followed in other countries However, in the coming years, the demand for gasoline is estimated to grow at a faster rate than diesel on account of increased urbanisation and preference for personalised transport The projected growth rate and demand profile of gasoline and diesel are presented in Annexure 2 and 3

3 PETROLEUM AND ENVIRONMENT

3.1 In the course of recent decades, the pollution of the local, regional and world environment as a result of growing consumption of petroleum products has become a subject of primary concern, particularly in the developed and developing countries. In this context, the massive proliferation of the automobiles and to some extent the growth in the number of industrial plants, have focused the attention of all concerned on the harmful effects resulting from the extensive use of fuel products and on the overriding need to combat the spread of pollution

3.2 About 45 % of the world's oil demand is for transportation Studies indicate that the transport sector is one of the largest source for contributing to the atmosphere, the pollutants like Carbon-monoxide (CO), Hydrocarbons (HC) and Nitrogen Oxides (NO_x)

The contribution of transport sector in terms of CO HC and NO_x in the total emissions is presented in Fig 1 below

Further, the reactions between hydrocarbons and nitrogen oxides (NO_x) in the presence of sunlight lead to formation of secondary pollutants like ozone and aldehydes giving rise to what is known as photochemical smog

The harmful effects of all these pollutants are well known and are presented in Annexure 4

It has also been observed that amongst the transport fuels, gasoline contributes most of the CO, HC & lead in the total vehicular pollution, while diesel driven vehicles are the chief source of NO_x, Particulates & SO_x

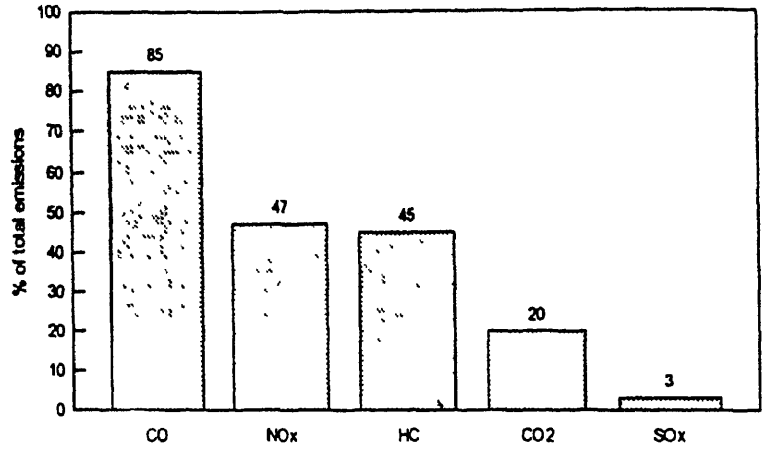


Fig 1 - Contnbution of transport sector to total emissions (world average)

The demand for gasoline and diesel is expected to increase world over due to higher per capita income, improved quality of life and the desire for mobility. As a result, control of emissions arising from the increased use of gasoline and diesel has naturally attracted attention worldwide

2.3 World-wide, the vehicular population is about 600 million, with more than two-thirds in US and other developed countnes. Compared to this, the total number of vehicles in India is infinitesimal - a mere 22 million i e less than 4% of the total vehicles in the world. Consequently, the consumption of transport fuels (gasoline and diesel) in India is almost negligible - less than 2 % - compared to the worldwide consumption of about 1750 MMT A comparison of transport fuels consumption in India in relation to some of the developed countnes is presented in Annexure 5

Inspite of the above, the vehicular pollution, particularly in the metropolitan and some of the major cities of the country has become a major problem in recent years The principal causes for the growing vehicular emissions can be attributed to the following

- Dunng the last 2 decades , the number of two wheelers in the country has multiplied by a factor of 5 6, while the passenger cars and diesel vehicles increased by about 2 6 times Most of this increase has taken place in the metropolitan and major cities due to increased preference for personalised transport in the absence of an efficient mass transport system in some of the major cities like Delhi and Bangalore, and conglomeration of industnes and commercial activities in the urban areas

- More than 70 % of the total vehicles in the country comprise of two and three wheelers (consuming about 60 % of the total gasoline) most of which are powered by small 2-stroke gasoline engines which emit high quantities of unburned HC and CO

3.0 EMISSION REGULATIONS

3.1 Increasing concern about urban air pollution has resulted in more and more stringent vehicle emission regulations all over the world.

In India , the first ever standard on mass emissions from gasoline vehicles was introduced from 1 4.1991 and for the diesel vehicles from 1.4.1992. These limits have been primarily derived from ECE (Economic Commission of Europe) regulations, although cycle and test procedure are different. A new set of emission regulations, effective from April 1996, have been notified which require 40-50 % reduction over the April 1991 standards. For the year 2000, the European Emission Standards of 1992 have been proposed based on Indian driving cycle The proposed emission standards for different categories of vehicles are given Table 3

Table 3 - Indian mass emission standards for various classes of vehicles

Vehicle Type	Effective Date	CO	HC	HC+Nox	NOx	PM
		grams/km				
2&3 wheelers	April 1991	12 0-13 0*	8 0-12 0	-	-	-
2 wheelers	April 1996 April 2000	4 5 2 0	- -	3 6 1 5		
3 wheelers	April 1996 April 2000	6 75 2 0	-	5 4 1 5		
Passenger Cars	April 1991 April 1996 April 2000	14 3-27 1# 8 68-12 40# 2 72	2 0-2 9 - -	- 3 0-4 36 0 97	- -	- -
	grams/kwh					
Diesel Vehicles	April 1992 April 1996 April 2000	14 0 11 2 4 5	3 5 2 4 1 1	- - -	18 0 14.4 8 0	- - 0 36

* Depends on gross weight of vehicle

\# Depends on engine cubic capacity

Source Pundir, B P , Jain Amar K and Gogia Dinesh K "Vehicle Emissions and control perspectives in India A state of the art report"

4.0 EMISSION REGULATION AND FUEL QUALITY CHANGES

4 1 Global Scenario

Majority of the reductions in emission all around the world, particularly in the developed countries like US and Europe has been achieved by efficient, clean-vehicle technology during the last 30 years Now the attention has been focused on developing clean fuels or reformulated fuels to effect further reduction in emissions and thus meet the stringent standards

- Outdated automotive technologies in use in the country
- Age of the vehicles and poor maintenance
- Congested traffic and poor road conditions etc

The contribution of various classes of vehicles in the total vehicular pollution during 1992-93 is presented in Table 1

Table 1 - Contribution of various classes of vehicles in total vehicular pollution

(Figs in % of total vehicular emissions)

Class of vehicles	CO	HC	NOx
Mopeds	10 8	17 0	0 2
Scooters/ Motor Cycles/3 wheelers	35.1	53 7	0 7
Total 2/3 wheelers	45 9	70 7	0 9
Passenger Cars	25.4	7.6	4 9
Diesel Vehicles	28 6	21 8	94 3

Source : Pundir, B P , Jain Amar K and Gogia Dinesh K "Vehicle Emissions and control perspectives in India . A state of the art report"

As can be seen, 2/3 wheelers, which are predominantly 2-stroke engines, contribute the bulk of HC (about 46 %) and CO (about 71%) in the total vehicular emissions and diesel driven vehicles are the principal source of NO_x (about 94 %)

The transport demand is expected to grow significantly in the coming years with more and more number of vehicles operating in the urban areas of metropolitan and major cities The number of 2/3 wheelers is estimated to grow at a very rapid rate and would constitute about 80 % of the total vehicle population in the year 2006-07 The projected population of gasoline and diesel driven vehicles in India is indicated in Table 2

Table 2 - Projected vehicle population in India

(Figures in million)

Year	Gasoline Driven		Diesel Driven*
	2/3 wheelers	4 wheelers	
1993-94	15 9 (74 0%)	2 7 (12 5%)	2 9 (13 5%)
1995-96	19 5 (75 6%)	3 0 (11 6%)	3 3 (12 8%)
2000-01	32 2 (78 3%)	4 2 (10 3%)	4 7 (11 4%)
2006-07	53 3 (79 8%)	6 3 (9 4%)	7 2 (10 8%)

* excluding tractors

Note Figures in brackets indicate % on total

Source OCC Report on Demand Projections of Petroleum Products, July 1994

Gasoline

Gasoline has received by far the greatest attention from the Environmentalists The first attempt by the automobile industry to combat pollution was the introduction of catalytic converters to convert the CO and HC from the exhaust of cars to harmless components and thereby reduce the ground-level ozone or smog which was causing concern in some of the major cities in US This necessitated lead phase-out from gasoline, as lead poisoned the noble metal catalyst employed in the catalytic converters The potential health hazard of lead was also realised and lead phase-down / phase-out began in the US in 1973 and unleaded gasoline was mandated since 1979 Elsewhere around the world, the campaign of lead phase-down / phase-out gained momentum and most of the countries have already drawn out a time-table for lead reduction and ultimately for production of unleaded gasoline

One fall out of the lead removal from gasoline was the impact on refinery operations The octane loss due to withdrawal of anti-knock lead additive necessitated increasing the seventy of naphtha reforming units and increased blending of high octane butane Consequently, there was a shift in gasoline composition Some of these shifts like increased volatility (due to blending of butane) and increased aromatics content (due to increased severity of naphtha reforming) had a negative impact on the fundamental goal of cleaner air In the mean time, the issue of benzene content also started attracting attention

The above developments set the stage for new regulations

In 1990, the US Government passed the "Clean Air Amendments Act (CAAA)" under which most of the US gasoline would have to be drastically reformulated For the the Reformulated Gasoline (RFG) program, the EPA (Environmental Protection Agency) is concentrating on the following four parameters which have considerable influence on the the emissions -

- Rvp (Reid Vapour pressure - which is a measure of volatility)
- benzene content
- aromatics content and
- oxygen content

Blending of oxygenates like Methyl Tertiary Butyl Ether (MTBE), Ethyl Tertiary Butyl Ether (ETBE), Tertiary Amyl Methyl Ether (TAME) etc has been mandated so as to have an oxygen content of at least 2 wt% but no more than 2 7 wt%, because excess oxygenates can result in increased NO_x emissions The effect of these four parameters i e Rvp, aromatics, benzene, and oxygen content on emissions is bnefly presented in Table 4

Although it is at less advanced stage, gasoline reformulation is underway in major industnalised countnes A lead phase-out is becoming a reality for the EEC countnes Stringent specifications for parameters like Rvp, sulphur and benzene content are also under consideration

Diesel

Of all the properties, the sulphur content of diesel has by far attracted the greatest attention as it was considered to be the chief cause of particulate emission Other

properties like ignition quality (cetane number), tail-end volatility (i.e distillation range of the tail-end portion), stability, density etc are also being improved all over the world

Table 4 - Effect of changes in some critical parameters of gasoline on emissions

Parameter	Effect on Emissions
Rvp (Reid vapour pressure)	Rvp is known to directly affect the evaporative emissions of Volatile Organic Compounds (VOCs). Higher the Rvp, higher are the evaporative emissions Rvp control is considered to be the most cost-effective way to reduce VOC emissions
Aromatics	Aromatics in exhaust are generally proportional to aromatics in the fuel Lower aromatics reduce the reactivity of emissions, produce less engine deposits and contribute to lower benzene emissions which are formed due to dealkylation of polyalkyl aromatics in the engine
Benzene	Benzene is a known carcinogen
Oxygen content	Oxygen content of gasoline can be improved through blending of oxygenates like MTBE, ETBE etc Oxygenates aid in more complete combustion which results in lower HC and CO emissions from exhaust and also minimises ground-level ozone formation However, beyond certain limit, oxygenates lead to increased NO_x emissions

4.2 Indian Scenario

In India, the quality of Gasoline and Diesel is in conformity with the Bureau of Indian Standards (BIS) Specifications.

In keeping with the worldwide trend, the first major fuel quality change related to the lead-phase down in gasoline Government has already drawn up following programme given in Table-5, for lead phase-down / phase-out from gasoline marketed in the country

With the introduction of newer designs of engines and the exhaust emission norms being mandated by the government, the specifications with respect to some of the

critical parameters of gasoline and diesel are under review The Ministry of Environment & Forests, BIS and other agencies like Petroleum Ministry are jointly developing revised BIS specifications for gasoline and diesel

Table 5 - Lead phase-down programme in India

	All four metros	Capitals of States / Union Territories	Rest of the country
Supply of low lead (0 15 gm/lit Pb) gasoline	Already in force from June 1994	December 1996	December 1996
Supply of unleaded (0 013 gm/lit Pb) gasoline for new cars fitted with catalytic converters	Already in force from 1 4 95	By 1998	By 1999-2000

In the case of gasoline, in addition to the existing parameters, some additional quality parameters have been introduced These are

- Motor Octane Number (MON) in the form of Anti knock Index (AKI) which is (RON+MON)/2
- Volatility characteristic in the form of Vapour Lock Index (VLI) which is computed as (10*Rvp in KPa + 7*E_{70}) - where E_{70} is % vaporised at 70°C

Some of the proposed revisions in specifications of gasoline and diesel which will have a major impact on the process configuration and refinery operations are indicated in Table 6 and Table 7 respectively

Table 6 - Proposed revised specifications of Gasoline - Regular grade

Parameter		Current Spec	Proposed Spec	Proposed - year 2000 (directional)
Research Octane Number, min		87	87	-
Anti Knock Index (AKI) - (RON+MON)/2, min		-	82	84*
Rvp @ 37 8°C, max	KPa	70	35 - 70	35 - 60
Lead Content, max	gm/lit (Pb)	**	**	**
Benzene Content, max	% vol	-	-	5

* corresponding to RON of 89

** As per Government directive

Table 7 - Proposed revised specification of Diesel

Parameter		Current Spec.	Proposed Spec.	Proposed year 2000 (directional)
Cetane Number, min		42	45	48
Sulphur content, max	% wt	1.0	*	*
Distillation - 90 % recovery, max. - 85 % recovery, max - 95 % recovery, max	° C	366 - -	366 - -	- 350 370

* As per the following Government directive given below .

- 0 50 % wt max for metros w e f. 1 4.1996
- 0 25 % wt max throughout the country w.e.f 1.4.1999.

5.0 IMPACT OF PROPOSED GASOLINE & DIESEL SPECIFICATIONS ON REFINERY OPERATIONS

Indian refinenes have a daunting task ahead in meeting the proposed stringent specifications of Gasoline and Diesel. This will call for major modifications to the existing process configuration, installation of additional process units, blending optimisation etc involving substantial investment in the next 4/5 years The toughest challenge will be in meeting the following

- benzene content limit in Gasoline, in the light of on-going lead-phase down / phase-out coupled with introduction of Motor Octane Number specification (in the form of AKI)
- diesel sulphur content of 0 25 % wt max

Indian refineries have already geared up to meet the above challenge and drawn up/drawing up necessary action plan These are briefly described in the following paragraphs

5.1 Benzene content in Gasoline

Benzene content in gasoline currently produced at various Indian refineries is given in Table 8

As can be seen from the above table, except for IOC-Haldia, the benzene content of gasoline currently produced at all other refineries is within 5 % vol However, with the commissioning of Catalytic Reforming Units (CRUs) which are under implementation at IOC-Barauni, IOC-Mathura and IOC-Digboi refineries at an estimated cost of Rs 900 crores (about US $ 300 million) to meet the lead phase-down programme promulgated by the Government, the benzene content of gasoline produced in these refinenes would increase to a level of 7-10 %

Table 8 - Benzene content in gasoline produced at various Indian refineries

Refinery	Benzene Content- % vol	
	Current level	After CRU
Indian Oil Corporation (IOC) - Guwahati	4 5 - 5 0	
Indian Oil Corporation (IOC) - Barauni	4 0 - 5 0	7 0 - 8 0*
Indian Oil Corporation (IOC) - Gujarat	2 5 - 3 5	
Indian Oil Corporation (IOC) - Haldia	5 0 - 6 0	
Indian Oil Corporation (IOC) - Mathura	2 5 - 4 5	8 0 - 9 0*
Indian Oil Corporation (IOC) - Digboi	2 5 - 3 5	9 0 - 10 0*
Bharat Petroleum Corporation (BPC)	3 0	
Bongaigaon Refineries & Petrochemicals (BRPL)	3 0	
Cochin Refineries Ltd (CRL)	< 5 0	
Hindustan Petroleum Corporation (HPC)- Bombay	2 7	
Hindustan Petroleum Corporation (HPC)- Visakh	2 0 - 4 0	
Madras Refineries Ltd (MRL)	2 2	

* Catalytic Reforming Units (CRU) are under implementation at these refineries to meet lead phase-down programme

Therefore, for meeting the benzene content limit of 5 % vol max at IOC-Barauni, IOC-Mathura, IOC-Digboi (post CRUs) and IOC-Haldia refineries, additional facilities will be required to be installed to maintain the production level of gasoline in these refineries The facilities that are envisaged are

- IOC-Barauni and IOC-Mathura Splitting of reformate into light and heavy streams and hydro-isomerisation of light reformate for blending into gasoline pool along with the heavy reformate

- IOC-Haldia Trimming of CRU feedstock to remove benzene precursors and blending of Methyl Tertiary Butyl Ether (MTBE) into gasoline

- IOC-Digboi Trimming of CRU feedstock alongwith marginal modifications in CRU splitter However, there will still be a production loss of about 20,000-25,000 tonnes per annum Since the production level of gasoline in this refinery is very low (about 65,000 tonnes/annum) no facilities are envisaged to make up this loss of 20,000-25,000 tonnes per annum

The estimated investment that would be required for setting up the above additional facilities will be about Rs 275 crores (about US $ 90 million) The time frame required for implementation of these facilities would be minimum 3 years after investment approval

As desired by the Central Pollution Control Board (CPCB), Ministry of Environment & Forests, a preliminary study was also carried out by the Centre for High Technology (Ministry of Petroleum & Natural Gas) to examine the feasibility of limiting the benzene content in gasoline marketed in the country to 1 0 % vol max This study has indicated that since the benzene content of gasoline for all the operating refineries in India is much above 1 % vol, major additional facilities like

hydro-isomerisation of light reformate, isomerisation/dearomatisation of naphtha, increased blending of oxygenates etc will be required to be installed in all the refineries to meet this limit and also maintain the production level. The estimated investment for these facilities will be very huge - of the order of Rs 1,450 crores (about US $ 480 million)

Considering that even in the environmentally conscious developed countries, there is immediately no proposal to restrict the benzene content to 1 % vol., a detailed review needs to be carried out before this limit is proposed for gasoline in India.

5.2 Diesel Sulphur Content

The current specification of sulphur content in diesel is 1 0 % wt max , and Indian refineries are able to meet this specification with the existing process configuration Most of the refineries in the country (except for eastern refineries viz IOC-Digboi, IOC-Guwahati, IOC-Barauni & BRPL, and IOC-Haldia which is a lube refinery based on imported high sulphur crude processing) are having Fluid Catalytic Cracking (FCC) unit as the major secondary processing facility These refineries also process varying quantities of high sulphur imported crudes and are able to meet the current specification of 1.0 %.wt max sulphur through blending of gas oil derived from low sulphur crude processing

However, for meeting the sulphur limit of 0.25 %wt w.e.f. 1 4 1999 as directed by the Government, Diesel Hydrodesulphunsation (HDS) plants, alongwith Hydrogen plants and other facilities such as amine treating, sulphur recovery unit, utilities & offsites etc where ever required, will need to be set up at most of the refineries in India A total of 9 Diesel HDS units at IOC-Gujarat, IOC-Haldia, IOC-Mathura, IOC-Panipat (grassroots refinery under construction), BPCL, CRL, HPC-Bombay, HPC-Visakh and MRL are already planned by the refining industry The estimated investment for Diesel hydrodesulphurising facilities at these refineries will be massive - of the order of Rs 4000 crores (about US $ 1300 million)

It may be pertinent to mention here that under the "Ten Point Initiative" by the Ministry of Petroleum & Natural Gas which is specifically aimed at improving the environment in the Agra-Mathura region, supply of low sulphur diesel has been planned for use in this region much ahead of schedule for rest of the country Diesel with sulphur content of 0.5 %wt is planned to be introduced from April, 1996 and from September, 1996, the sulphur content in diesel supplies to this region will be restricted to 0 25 %wt Further, to bring down the sulphur-dioxide concentration in this region, a Hydrocracker Unit is also planned to be set up at Mathura refinery at an estimated cost of Rs 1020 crores (about US $ 340 million)

With respect to the proposed ignition quality (cetane number), no problems are anticipated in meeting the revised specification in most of the refineries However, in case of north-eastern refineries viz IOC-Digboi, IOC-Guwahati, IOC-Barauni and BRPL which process very high aromatic Assam crude which yields low cetane number diesel it would not be possible to meet the cetane of 45 and 48 (directional specification - year 2000) with addition of cetane improver alone The quantum of diesel production in these refineries is also very low and alternative strategies are being worked out to meet the cetane number specification at these refineries

As regards the proposed specification in respect of distillation range i e 85 % recovery at 350 °C and 95 % recovery at 370 °C (directional specification - year

2000), preliminary study indicates tha. the proposed changes will have a very serious impact on refinery operations and availability of diesel in the country It is estimated that the diesel production loss on account of this alone will be enormous - of the order of 2 0-2 5 MMTPA out of a total production level of about 19 5 MMTPA at present Further, there will a substantial increase in the generation of heavy ends at the refineries which would pose serious problems with respect to its handling and disposal The loss in diesel production can partly be made up by augmenting and/or providing additional secondary processing facilities to process the additional heavy ends generated Installation of such facilities would, however, need huge investments and a detailed study would be required by each refinery

It may be mentioned here that a project costing Rs 1 3 crores, has been sponsored by Centre for High Technology, Ministry of Petroleum & Natural Gas to study the effect of some of the critical parameters, including the distillation range, of diesel on CO, HC, NO_x and particulates emission from typical diesel engines produced in the country The project expected to be completed by December 1997, will also arrive at diesel fuel specifications for meeting the year 2000 emission standards and directions of changes in fuel quality beyond the year 2000 It would, therefore, be prudent to await the findings of this project before taking a final view on the changes in the specification in respect of distillation range

5 3 In all, during the next 3 to 4 years Indian refineries will be investing more than Rs 5000 crores (about US $ 1650 million) towards improving the quality of gasoline and diesel to meet stringent specifications

6.0 CONCLUSION

Worldover, the pollution caused by the explosive growth in the number of gasoline and diesel driven vehicles, particularly in the major cities, is of primary concern today As a result, upgrading the quality of gasoline and diesel has attracted greater attention compared to any other petroleum product

However, vehicular emission is a complex phenomenon and apart from fuel quality, it is governed by many factors like engine design, maintenance, driving habits, traffic & road conditions etc It is, therefore, important to understand and address these issues as a whole for effective and long-term reduction in vehicular emissions In the case of developed countries, as already mentioned, major reduction in vehicular emission has been achieved through continuous improvement in vehicle technology, improved traffic management etc and the current fuel reformulation programme aims to effect further lowering of the emissions through improved quality of transport fuels

Studies indicate that the three major factors, in the order of importance, which influence emissions are

- Vehicle technology and Engine maintenance
- Traffic conditions and driving pattern
- Fuel composition/quality

The increased environmental pollution due to vehicular emissions in the urban areas of major cities in India, is primarily because of the first two factors mentioned above There are no two opinions that clean and improved fuels can efficiently

contribute towards reducing vehicular emissions. However, unless we develop efficient and clean-vehicle technology and improve traffic conditions, adopting only the fuel quality specifications of the developed countries, would not be an efficient strategy in the long term While technologies are available for improving the fuel quality, it should be remembered that these are highly capital intensive and take minimum 3 to 4 years for implementation The additional burden to the consumer on account of setting up major facilities in the refineries at enormous cost should also be kept in view

In this connection, it would be of interest to note the "Tripartite Initiative" to be taken up in Europe This is a unique collaborative project involving oil industry, vehicles industry and the Government which will seek to manage future air quality in a rational way and identify the most effective steps towards meeting society's expectations One of the vital factor in this entire project is the cost / benefit analysis of changes in refinery operations, vehicle manufacturing technology and social changes such as traffic restriction etc. which need to be considered and compared/evaluated.

India's oil industry is fully conscious of its responsibility towards supplying quality products and contribute to environmental protection During the next 3 to 4 years, the oil industry will be investing more than Rs 5000 crores (about US $ 1650 million) towards improving the quality of gasoline and diesel marketed in the country. The vehicle technology is also expected to be modernised and improved to meet the proposed emission standards This will also call for considerable investments With these measures, we can expect considerable reduction in the vehicular emissions in the major cities In order to reap the benefits of improved fuel quality and better vehicle technology, the thrust during the coming years, therefore, will be on proper maintenance of the old vehicles, improving the traffic conditions and continued public awareness campaigns etc

References

1 *"Hydrocarbon Perspective . 2010 - Meeting the challenges"* - Report of the Study Group constituted by Ministry of Petroleum & Natural Gas, Govt of India

2 *Douaud, A "Tomorrow's engines and fuels"* - Hydrocarbon Processing, February, 1995

3 *Pundir, B P. and Prasada Rao, T S R , "Fuel quality challenges for Indian oil industry"* - Eighth Refinery Technology Meet, Madras, 1995

4 *Pundir, B P , Jain Amar K and Gogia Dinesh K "Vehicle Emissions and control perspectives in India A state of the art report"*

5 *"World-wide Fuel Reformulation Status Report"* - Hydrocarbon Publishing Company, USA

6 *Dilip Biswas and Dutta S A , "Vehicular Pollution Combating the smog and noise in cities"* - The Hindu Survey of the Environment, 1994

About the author

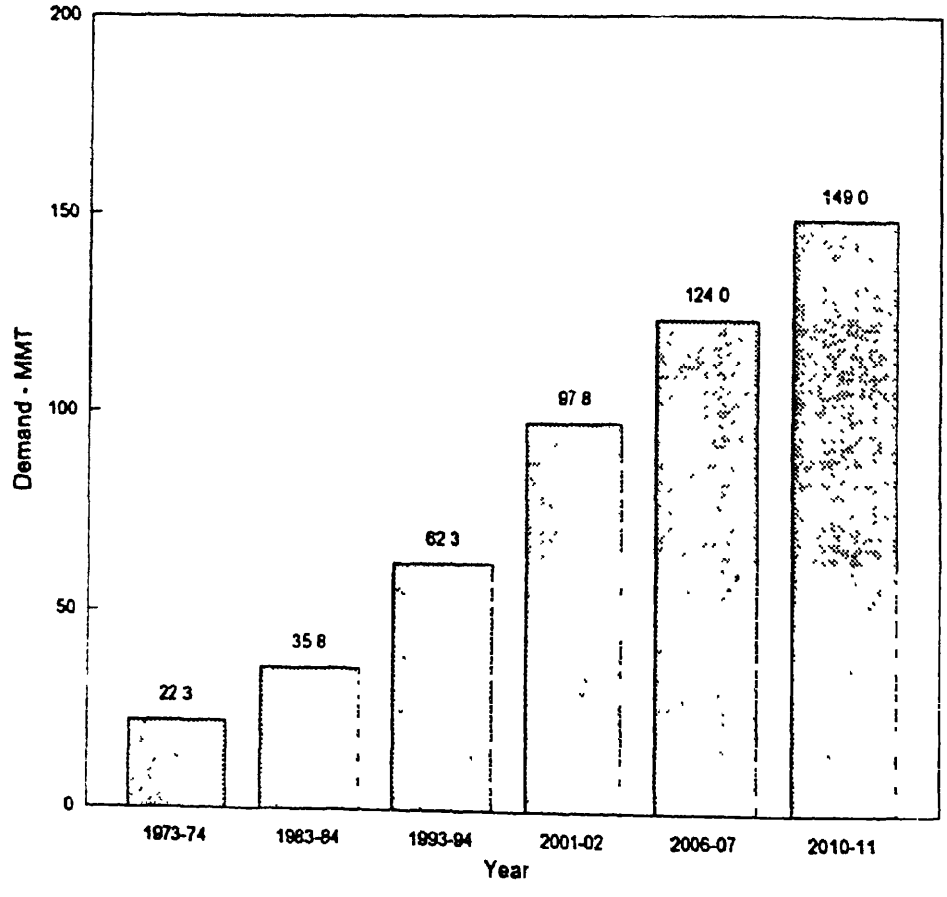
Mr A P. Chaudhri, a well known figure in the oil industry in India, holds a Master's Degree in Power Engineering from Indian Institute of Science, Bangalore. He joined the erstwhile Indian Refineries Ltd as an engineer trainee in 1959 and rose to the position of Director (Refineries & Pipelines), Indian Oil Corporation. As Director (Refineries & Pipelines), he was responsible for operations, maintenance, administration, human resource development, training, finance etc of all the six refineries (Guwahati, Barauni, Gujarat, Haldia, Mathura and Digboi) under Indian Oil Corporation and also the vast network of crude and product pipelines He directed the formulation and implementation work on number of projects, including mega projects like i) Panipat Refinery ii) Kandla Bhatinda Product Pipeline, iii) Catalytic Reformers at Digboi, Barauni & Mathura refineries As Director (Refineries & Pipelines) he was also holding additional charge as Director (Research & Development) Prior to becoming a Director on the Board of Indian Oil Corporation, Mr. Chaudhri worked as head of Indianoil's Barauni and Gujarat refineries and worked in various capacities in these refineries as also other refineries of the Corporation.

On his superannuation from Indian Oil Corporation, Mr Chaudhri was appointed Executive Director of Centre for High Technology (CHT) by the Government. CHT is a centralised organisation for the oil industry in India for helping to achieve improved performance and technological upgradation in the areas of oil refining, transportation and application of petroleum products etc CHT is closely associated with technology selection/upgradation of existing/grassroots refineries, development of indigenous technology by way of sponsoring R&D projects and has also contributed significantly in the finalisation of future specifications of Motor Spirit and Diesel. CHT is also called upon to render assistance to various committees/expert bodies constituted by Ministry of Petroleum & Natural Gas in the formulation of future policy guidelines for the oil industry

Mr Chaudhri is the member-secretary of the Expert Group, constituted by the Ministry of Petroleum & Natural Gas, to review the "Technological Gaps in Indian refineries" Besides being a member on various committees of the Ministry, he is also a member of the Research Council and Technical Advisory Board of Indian Institute of Petroleum, Dehradun

ANNEXURE - 1

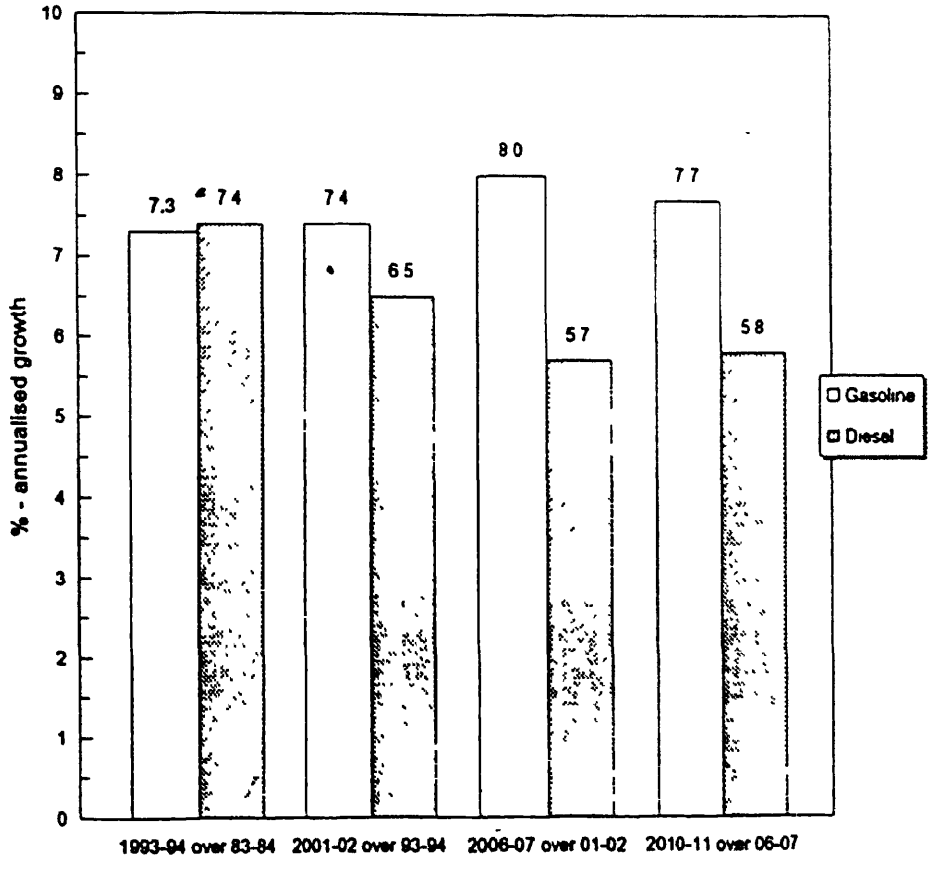
Demand Profile of Petroleum Products in India



Source : "Hydrocarbon Perspective : 2010 - Meeting the Challenges" Report of the Study Group constituted by Ministry of Petroleum & Natural Gas, Govt. of India

ANNEXURE - 2

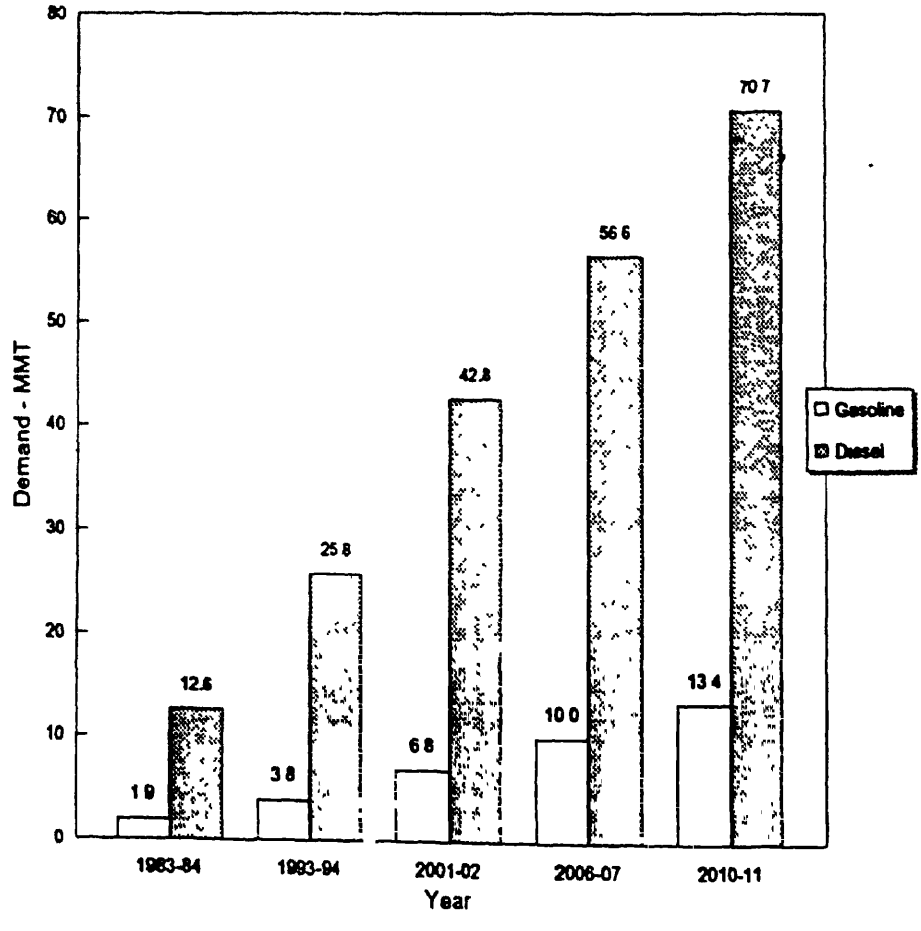
Projected Growth Rate of Gasoline and Diesel in India



Source : "Hydrocarbon Perspective : 2010 - Meeting the Challenges" - Report of the Study Group constituted by Ministry of Petroleum & Natural Gas, Govt. of India

ANNEXURE - 3

Demand Profile of Gasoline and Diesel in India



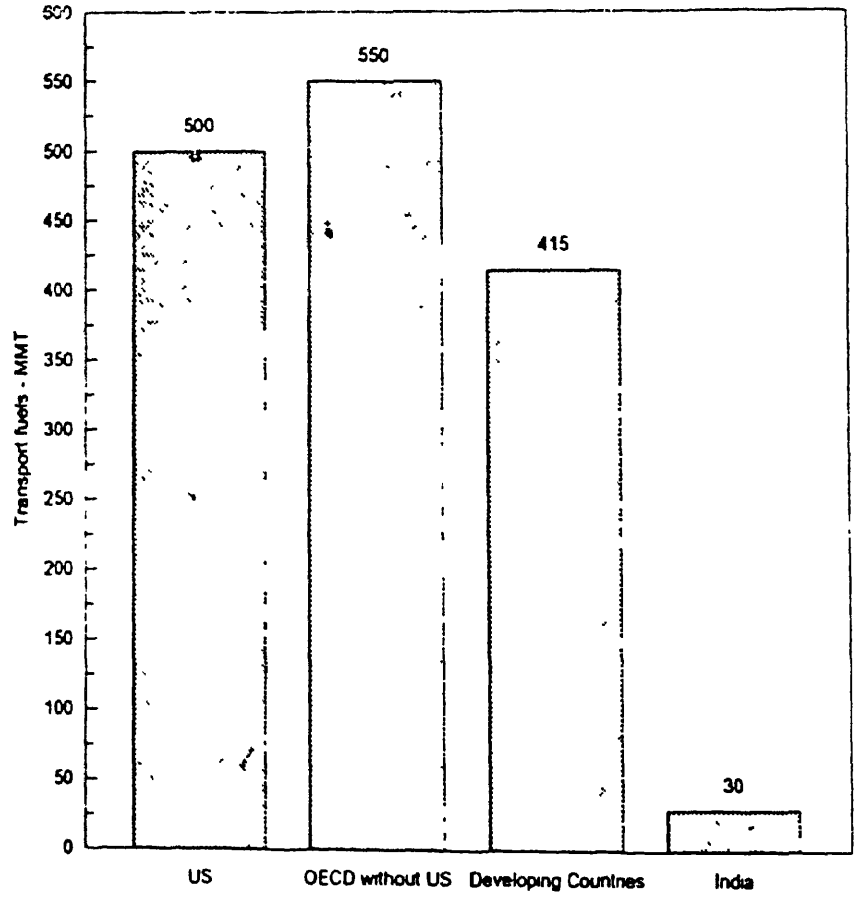
Source : "Hydrocarbon Perspective : 2010 - Meeting the Challenges" - Report of the Study Group constituted by Ministry of Petroleum & Natural Gas, Govt. of India

ANNEXURE - 4

Emission	Environmental Impact
CO	• Impairs blood's ability to absorb oxygen • CO concentrations become particularly dangerous in winter when temperature inversions trap accumulated CO under a stream of warmer air
CO_2	• Contributes to global warming
Unburned HC	• Predominant in gasoline powered vehicles • Inhalation of toxic Volatile Organic Compounds, (VOCs) like Benzene, 1,3-Butadiene etc may cause cancer and reproductive problems. • Formation of ground level ozone (due to reaction with NOx in the presence of sunlight) causes lung and eye irritation and damage to immune system Also contributes to global warming and damage to crops.
Particulates (includes exhaust HC, acidic salts and soot)	• Causes damage to the lungs
NO_x	• Inhalation causes or aggravates respiratory disorders. • Damages vegetation • Nitric acid is produced as a secondary reaction. Inhalation of nitric acid droplets causes severe damage to lung tissue. Deposition or acid rain causes damage to vegetation and aquatic life Also corrodes buildings • Nitrates that are produced cause respiratory problems • Leads to formation of ozone
SO_2	• Aggravates respiratory diseases. Causes irritation in eyes and respiratory tracts
Lead oxides/ particulates (in case of leaded gasoline)	• Affects nervous system, circulation, kidneys and reproductive system

ANNEXURE - 5

Demand of Transport Fuels (Gasoline+Diesel) In Developed Countries
During the Year 1993



Source : Douaud, A "Tomorrow's Engines and Fuels" -
Hydrocarbon Processing, February 1995

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR A. P. CHAUDHRI
Executive Director, Center for High Technology,
New Delhi, India

Mr A P Chaudhri, a well known figure in the oil industry in India, holds a Master's Degree in Power Engineering from Indian Institute of Science, Bangalore He joined the erstwhile Indian Refineries Ltd as an engineer trainee in 1959 and rose to the position of Director (Refineries & Pipelines), Indian Oil Corporation As Director (Refineries & Pipeline), he was responsible for operations, maintenance, administration, human resource development, training, finance etc of all the six refineries (Guwahati, Barauni, Gujarat, Haldia, Mathura and Digboi) under Indian Oil Corporation, and also the vast network of crude and product pipelines He directed the formulation and implementation work on a number of projects, including mega projects like i) Panipat Refinery ii) Kandla Bhatinda Product Pipeline, iii) Catalytic Reformers at Digboi, Barauni & Mathura refineries Prior to becoming a Director on the Board of Indian oil Corporation, Mr Chaudhri worked as head of Indian Oil's Barauni and Gujarat refineries, and worked in various capacities in other refineries

On his superannuation from Indian Oil Corporation, Mr Chaudhri was appointed Executive Director of Centre for High Technology (CHT) by the Government CHT is a centralis d organisation for the oil industry in India for helping to achieve improved performance and technological upgradation in the areas of oil refining, transportation and application of petroleum products etc CHT is closely associated with technology selection/upgradation of existing grassroots refineries, development of indigenous technology by way of sponsoring R&D projects and has also contributed significantly in the finalisation of future specifications of Motor Spirit and Diesel CHT is also called upon to render assistance to various committees expert bodies constituted by the Ministry of Petroleum & Natural Gas in the formulation of future policy guidelines for the oil industry

Mr Chaudhri is the member-secretary of the Expert Group, constituted by the Ministry of Petroleum & Natural Gas to review the "Technological Gaps in Indian Refineries" Besides being a member of various committees of the Ministry, he is also a member of the Research Council and Technical Advisory Board of the Indian Institute of Petroleum, Dehradun

Mr Chaudhri, has gone abroad many times, and is an erudite speaker He has delivered key note addresses and presented papers in seminars and conferences at national & international levels

OMAN INDIA PIPELINE: A PROJECT OVERVIEW

MR PETER M ROBERTS
Project Executive, Oman India Pipeline
Oman Oil Company Inc
Houston, USA

LUNCHEON ADDRESS

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR PETER M. ROBERTS
Project Executive, Oman India Pipeline,
Oman Oil Company Inc, Houston, USA

The paper has been written by the Oman India Pipeline management team and is presented by the Project Executive, Peter M Roberts

Peter Roberts graduated in Civil Engineering from Imperial College, London and performed extensive postgraduate studies in civilian and military Naval Architecture and Ocean Sciences

After a period of service as a Naval Constructor in the Royal Navy, his career has included senior technical corporate management, and project management assignments with Brown & Root U K Limited J P Kenny Group, and the Oman Oil Company Inc

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL VII

OUTLOOK FOR CRUDE & PRODUCT TRADE

PANEL CHAIRMAN : **DR FEREIDUN FESHARAKI**
Director, Program on Resources
East-West Center
Hawaii, USA

PANELLISTS : **MR S C MATHUR**
Director (Finance)
Indian Oil Corporation Ltd.
New Delhi, India

MR PETER WILDBLOOD
Chief Executive
The International Petroleum Exchange
of London Limited
London, UK

MR MADISON GALBRAITH
Managing Director
Commodity Advisory Service Group
Merrill Lynch Global Commodities
New York, USA

IOGC'95

DR FEREIDUN FESHARAKI
Director, Program on Resources
East-West Center, Hawaii
Past President,
International Association for Energy Economics

OUTLOOK FOR INTERNATIONAL TRADE IN CRUDE & PRODUCTS: 1995 - 2005

MR S C MATHUR
Director (Finance)
Indian Oil Corporation Limited
New Delhi, India

Paper to be distributed separately

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR SURESH CHAND MATHUR
Director (Finance), Indian Oil Corporation Ltd.
New Delhi, India

Mr Suresh Chand Mathur is the Director (Finance) of Indian Oil Corporation, the only Indian company in the 1995 Fortune "Global 500" with an annual turnover of over US$9 Billion

A full-time Board member of Indian Oil, he manages crucial functions such as finance, Planning, International Trade Internal Audit, International Financing

Starting his career with Indian Oil as a Finance Executive in 1966, over the past three decades, Mr Mathur has handled various key functions such as Finance, Corporate Planning, Systems, Project Management, Marketing & Operations, Human Resource etc

Prior to taking up his assignment at Board level Mr Mathur was overall incharge of IOC's North Zone as Executive Director, and also the Regional Oil Coordinator for the Oil Industry Shri Mathur headed the International Trade Division responsible for the country's Import of Crude and Petroleum Products as General Manager, and effectively managed oil imports, particularly, during the Gulf Crisis in 1990-91

CRUDE PRICING MECHANISMS

MR PETER WILDBLOOD
Chief Executive
The International Petroleum Exchange of London Limited
London, UK

India Oil & Gas Conference

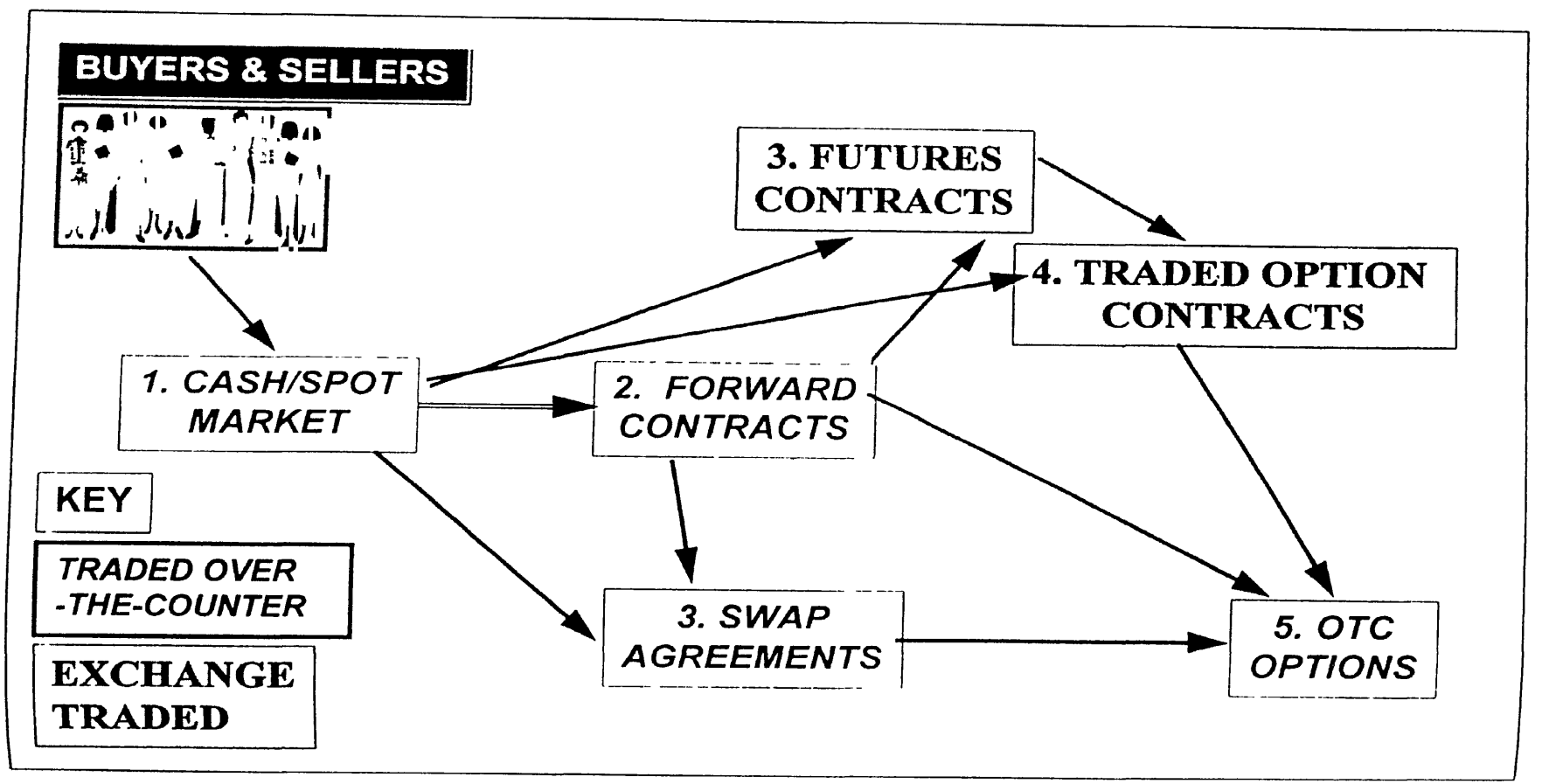
Crude Pricing Mechanisms

Taj Palace Inter-Continental, New Delhi, India
September 26th, 1995

Presented by

International Petroleum Exchange

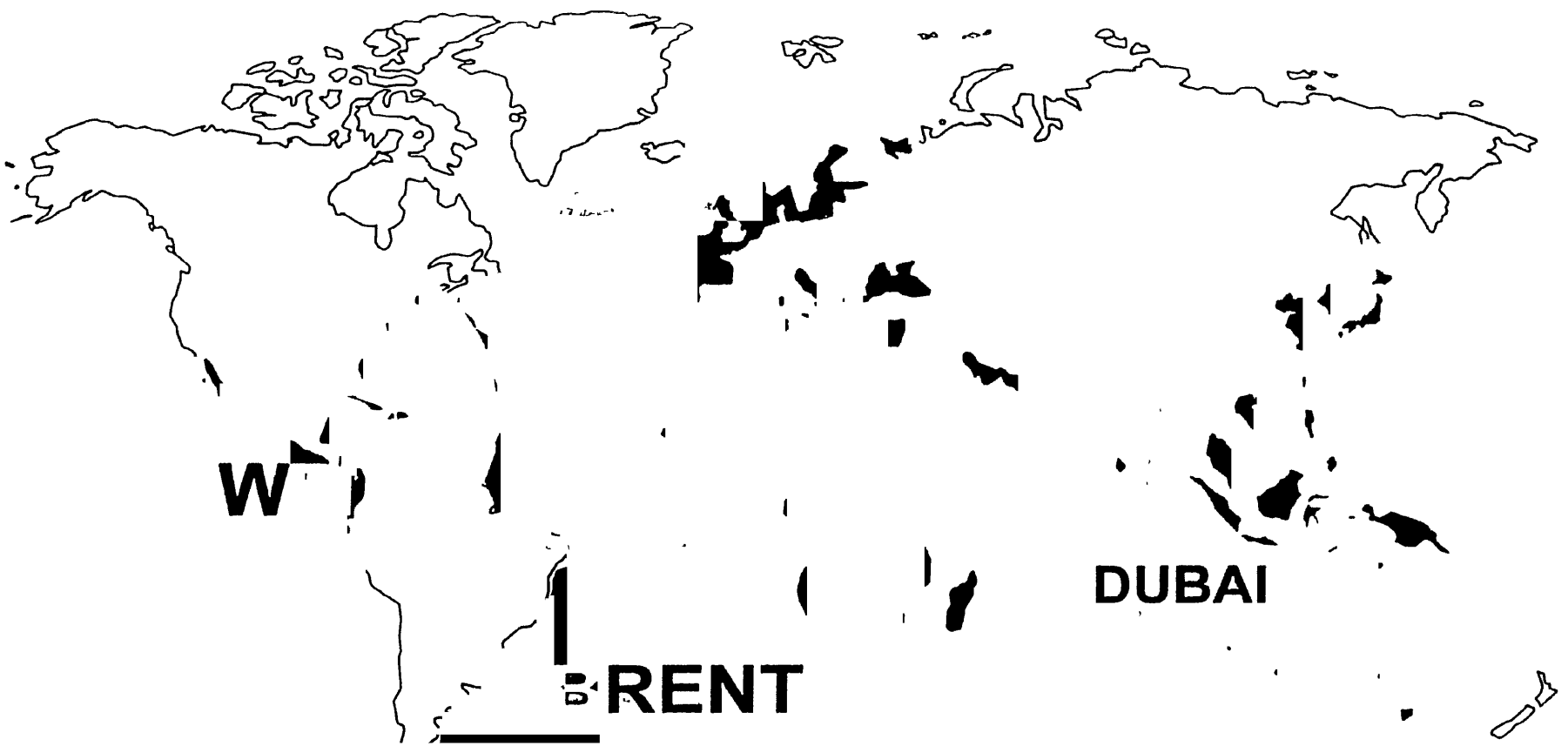
EVOLUTION OF THE MARKET



Pricing Vehicles

- Term
  - Government Selling Price
  - Netbacks
  - Spot at time of loading
  - Spot Related Averages/indices
- Spot
  - freely negotiated fixed price
  - priced against a benchmark
- Futures and swap prices
- Tenders

Global Benchmarks



BENCHMARKS
~What & Why ?

- Benchmarks provide a standard industry reference point which is fair, market related, transparent and understood by all participants.
- Benchmarks facilitate business by providing a focal point for differential pricing of related commodities
- Example : Brent minus $.50

REQUIREMENTS FOR A BENCHMARK CRUDE

- Sufficient supply and widely traded
- Price transparency
- Ease of entry/exit
- Broad range of participants
- Narrow bid/ask spread
- No political limitations

All these conditions result in a fair, acceptable and liquid market

Asia Pacific Benchmarks

- Tapis
- Minas
- Dubai/Oman
- Brent

BENCHMARK ANALYSIS

	Main use in A-P
TAPIS	Mainstay of the light sweet crude
MINAS	Mainstay of the medium to heavy sweet crude
DUBAI/OMAN	Markers for most Middle East grades imported into Far East, but increasingly Brent related
BRENT	Limited direct use in A-P but gaining momentum quickly

BENCHMARK ANALYSIS

	Main use in A-P	Strength
TAPIS	Mainstay of the light sweet crude	**Highly reactive with wide acceptance**
MINAS	Mainstay of the medium to heavy sweet crude	**The only indigenous benchmark**
DUBAI/OMAN	Markers for most Middle East grades imported to Far East, but increasingly Brent related	**No other alternative at present**
BRENT	Limited direct use in A-P but gaining momentum quickly	**Reactive and difficult to manipulate**

BENCHMARK ANALYSIS

	Main use in A-P	Strength	Weakness
TAPIS	Mainstay of the light sweet crude	Highly reactive with wide acceptance	**Limited production with concern about possible producer dominance**
MINAS	Mainstay of the medium to heavy sweet crude	The only indigenous benchmark	**Major influence of Japanese buyers**
DUBAI/OMAN	Markers for most Middle East grades imported to Far East, but increasingly Brent related	No other alternative at present	**Declining production with few participants**
BRENT	Limited direct use in A-P but gaining momentum quickly	Reactive and difficult to manipulate	**Still undergoing a process of acceptance**

BENCHMARK ANALYSIS

	Main use in A-P	Strength	Weakness	Price Transparency
TAPIS	Mainstay of the light sweet crude	Highly reactive with wide acceptance	Limited production with concern about possible producer dominance	**Reasonable**
MINAS	Mainstay of the medium to heavy sweet crude	The only indigenous benchmark	Major influence of Japanese buyers	**Moderate to poor**
DUBAI /OMAN	Markers for most Middle East grades imported to Far East, but increasingly Brent related	No other alternative at present	Declining production with few participants	**Moderate to poor**
BRENT	Limited direct use in A-P but gaining momentum quickly	Reactive and difficult to manipulate	Still undergoing a process of acceptance	**Excellent. Increasing number of crudes now priced off Brent.**



PRICING CRUDE OIL IN INDIA

BENCHMARKS & RISK MANAGEMENT

- The most accepted benchmarks trade associated futures contracts
- This permits either buyer or seller to fix price at their discretion
- The small lot size and concentrated liquidity permits maximum flexibility in managing risk in physical or OTC markets
- Absolute price risk can be managed separately from basis risk
- The contract terms are fair and secure for both buyers and sellers
- The price in the market is transparent to all
- The liquidity and transparency in the futures contract minimises market distortion

The Future

DEMAND - Asia-Pacific is fastest growing region.

SUPPLY - Indigenous export availability will decline.

$\therefore$ the regional dependence on imports from the Middle East and Atlantic Basin will increase.

Regional or Global Benchmark ?

- Dubai production is declining
- No other Middle East benchmark is currently in prospect
- Tapis and Minas are specialist crude oils
- The Far East world price influence will grow

Price Risk Management

WILL INCREASE

- DEREGULATION
- PRIVATISATION
- GREATER GLOBAL COMPETITION & PRICE INFLUENCE
- PRICE -> SUPPLY SECURITY
- MORE OIL COMPANIES AND FAR EAST BANKS/FUNDS WILL PARTICIPATE

$\therefore$ **DEMAND FOR A BENCHMARK AND ASSOCIATED RISK MANAGEMENT TOOL WILL INCREASE**

BRENT CRUDE CONTRACT

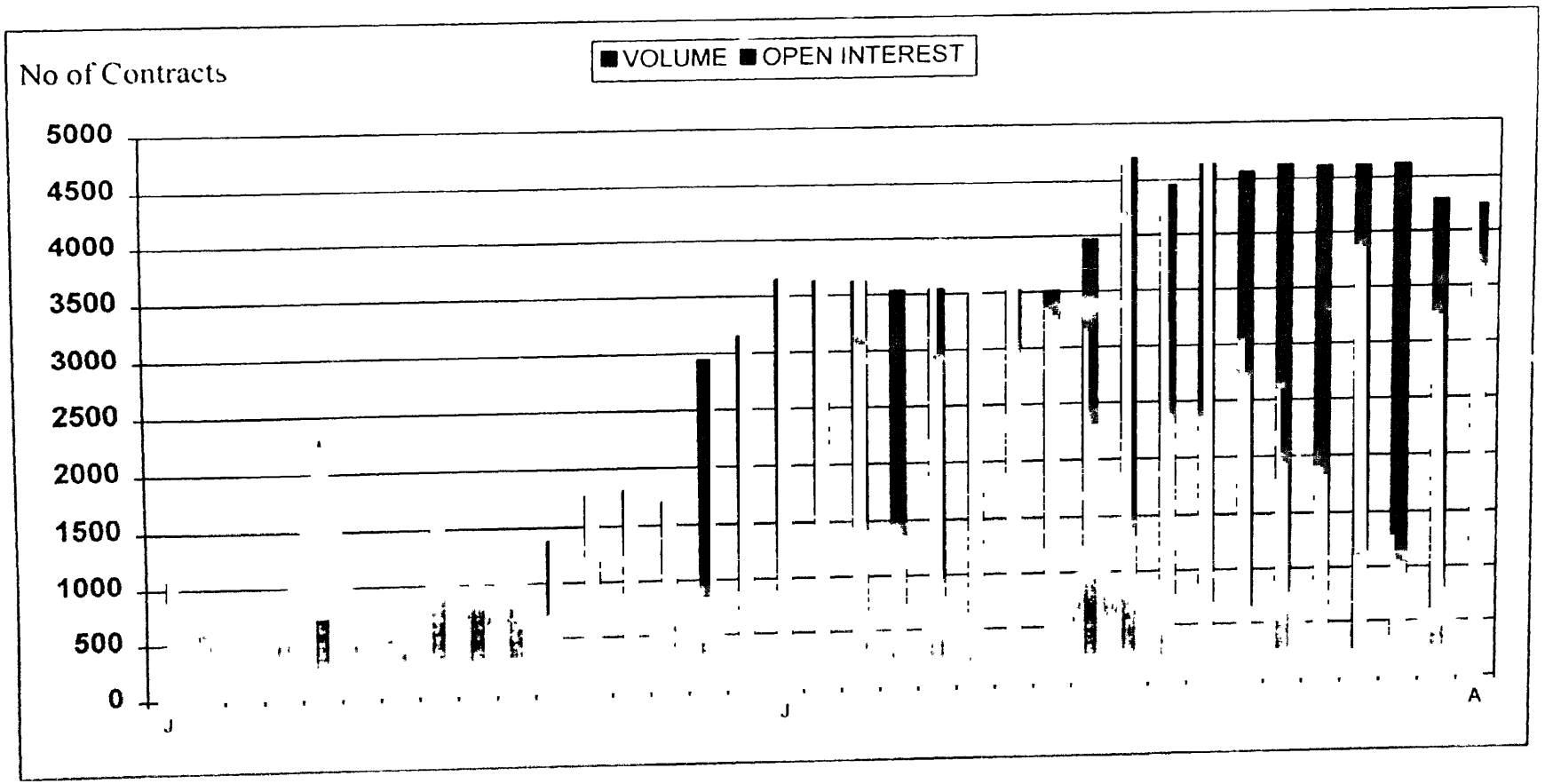
~IPE/SIMEX MUTUAL OFFSET AGREEMENT~

SIMEX

- **Extending Trading Hours**
  - ✓ From 11 to 18 hours a day
  - ✓ No overlap of hours between IPE/SIMEX
- **Liquidity**
  - ✓ Daily trade of 50 million barrels per day
  - ✓ Link provides immediate open interest of 150 million barrels
  - ✓ Narrow bid/ask price (1-2 cents)
  - ✓ Broad market participation
  - ✓ Greater accessibility to Asia Pacific Market
- **Price Transparency**
  - ✓ Extended to Asia/Pacific Market
  - ✓ No credible alternative

SIMEX BRENT FUTURES

DAILY VOLUME & OPEN INTEREST SINCE INCEPTION



The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR PETER WILDBLOOD
Chief Executive
The International Petroleum Exchange of London Limited

Peter Wildblood has been involved with the International Petroleum Exchange (IPE) since its inception, becoming its Chief Executive in April 1986

From the futures side of the business, his involvement in the development of the IPE at all stages including the devising of all of its contracts, has given him a unique insight into both the physical and futures side of oil trading and their relationship

He is a frequent lecturer on this subject at international oil and futures conferences worldwide and a regular contributor at the Institute of Petroleum in London and the College of Petroleum Studies in Oxford

He has represented the industry on various Bank of England committees, the British Invisibles Exports Council, the International Chamber of Commerce and is currently a Director of the Futures and Options Association

He was awarded the OBE for services to the futures industry

RISK MANAGEMENT & HEDGING: CONCEPT & APPLICATIONS IN THE INTERNATIONAL OIL MARKETS

MR MADISON GALBRAITH
Managing Director
Commodity Advisory Service Group
Merrill Lynch Global Commodities
New York, USA

Good Afternoon Ladies and Gentlemen

On behalf of DSP, Smith New Court and Merrill Lynch , I am very pleased to be with you this week and to be included in this dynamic seminar

I would like to talk with you today about Risk Management and Hedging and briefly discuss some specific examples, but first I'd like to discuss the philosophy of Risk Management

Over the years I have found that when discussing Risk Management with people they tend to describe the process with words like trading and gambling So before I talk about what Risk Management is I'd like to tell you what it is not It is not Barings It's not uncontrolled, it is not gambling, it is not egotistical, it is not undisciplined, it is not unplanned On the contrary it is a thought-out plan A plan that helps determine how to achieve your corporation's goals and strategies It does this by using Futures & Options to offset the risks that decrease your profits In other words - "you do not have to let the market place control your destiny ' I repeat - you do not have to let the market place control your destiny "

The International Oil Community has many financial tools to help it achieve its objectives As each corporation has different goals, each one will use these Futures & Options tools differently A company's business plan will include

Goals/Objectives

Plans

Budgets

Strategies (Risk Management)

Discipline (Guidelines)

Timing

Execution

Accounting

Risk Management Program

The objective of any risk management program is to minimize those risks over-which the company has no control Principal among these is the price volatility risk

Defining That Risk

In your risk management program you evaluate what price risk you have - depending on your net position Position is one's status in the market Your position in the market defines your risk whether long or short

For Example Your natural position is that which results from your company's day to day operation

A producer's position is naturally "long" because he constantly generates additional product

A refiner's position is naturally short" because he is generally short crude as they always need 'feedstock' to run the refinery

Mr Wildblood has given you information about the futures and options market - the most transparent tool that is currently used in hedging your risk

Let's talk about hedging Hedging is a financial tool for reducing price and profit risk A true hedger holds a futures market position which is opposite the hedger's current or anticipated cash market position It works by fixing prices and margins in advance thereby reducing the

It is a simple but straight forward example of hedging where a corporation that needs crude, and therefore is short establishes a long hedge to offset any future price volatility or upward move

This brings up an interesting point - what "causes" are there in the market place that create risk' for your 'goals' that therefore can seriously effect your profitability

OIL PRICE

Supply & Demand

Conservation Laws	Logistics
Country Demand	Market Views
Crude Quality	Political Events
Environment	Production
Finances	Refinery Capabilities
Freight Cost	Technology Levels
Government Policies	Weather
Hydrocarbon Switching	World Events
Inventory Levels	

All the above effect our budgets Budgets are set up to guide us financially The trading community uses the futures and options to achieve their goals and budgets and to offset their risk by hedging against major potential price movements This is being a pro-active manager one who acts - not one who re-acts

potential for loss or competitive disadvantage In so doing, however, the hedger foregoes the potential for windfall gains That is, the windfall gain from rising market prices is foregone by the short futures hedge, which commits to the future sale of the product at a fixed price Similarly the windfall gain from a falling market is foregone by the long hedge, which commits the purchaser to a fixed cost Fixed is fixed, no matter which way the market goes

Short vs Long Hedge

If a company is "long" in the cash market (e g it holds inventory in excess of immediate requirements), the natural hedge would be to "short" or sell contracts in the futures market A company that is "short" in the cash market (e g it needs barrels in order to meet cash market commitments) would be a natural "long," or buyer of contracts in the futures market A short hedger sells futures contracts to protect against the possibility of declining prices which would erode the value of inventory and thereby generate losses in the cash business The long hedger buys futures contracts to protect against the possibility of rising costs which can generate losses or reduced margins in the cash business when the actual product is purchased

Example For Hedging

Early 1994 one of my customers decided that he thought he could buy crude oil at an average of $16 00 per barrel for 12 months out He proceeded to buy over a 5 week period the futures market for a large portion of his need The market moved higher over that 5 week period and they purchased an average of approximately $16 75 per barrel Later he sold out his futures as he bought the real crude on the cash market The average purchase formula priced out at $17 85 Therefore he was able to apply $1 10 he received off the futures to he reduce his actual cash price

India is rapidly changing and will have increasing risk as it decontrols and becomes an even larger participant in the international market-place Recently I had the privilege of speaking with Dr Kelkar of the Ministry of Oil and Natural Gas We discussed Risk Management and he gave me some valuable information He told me that it is paramount that all corporations understand their ability to control their budgets and destiny How is this achieved? By understanding the concept of futures & options With these tools you can actively & successfully manage the risks to your budgets

I remember one oil refinery manager once telling me of his frustration He said "I do the same thing every year - yet some years I make a lot of money but some years I lose a lot of money I don't know how to stop the bad years"
He had no risk management plan - and no control of his budget! He was at the market's mercy Not a good way to run a business

With India's demand for more oil, your need for more creative ways to manage your price risks is growing dramatically It' an exciting time and we will be there with you to help you understand how to use these financial tools I feel very lucky to have the opportunity to be a part of this growth penod I've spoken in very general terms today because the first step is to help you understand the nature of the price risk, and to assure you that there are solid management programs in futures & options designed to minimize these risks and give you the ability to control your corporate destiny

Thank you

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR L. MADISON GALBRAITH
Managing Director, Merrill Lynch Debt and Equity Markets Group,
New York, USA

A Commodities trader broker since 1974 Over 10 years with Cargill trading grains and energy products Since joining Merrill Lynch in 1985 - has been a Senior Vice President on the Energy Desk for 9 years, and is now the Managing Director for the Commodity Advisory Service Group, which is responsible for all exchange traded commodities worldwide

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental Hotel
New Delhi, India

PANEL VIII

PERSPECTIVES FROM INTERNATIONAL OIL COMPANIES

PANEL CHAIRMAN : MR R K BATRA
Advisor, Corporate Sector
Tata Energy Research Institute (TERI)
New Delhi, India

PANELLISTS : MR STEVEN K WELCH
Vice-President
International Business Development
Amoco Petroleum Products
Chicago, USA

MR FRANZ B EHRHARDT
Executive Consultant,
Frontier Business Development
Downstream Operations
Conoco Inc
Houston, USA

R K BATRA
Advisor, Corporate Sector,
Tata Energy Research Institute,
New Delhi

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR R K BATRA
Advisor, Corporate Sector, Tata Energy Research Institute
New Delhi, India

Mr R K Batra is an advisor to the Tata Energy Research Institute on corporate sector areas of interest i e , energy policy, energy conservation/efficiency and environmental issues He has also directed and coordinated specific projects related to energy and environmental policies in general and the hydrocarbon sector in particular for domestic and international oil and gas companies

Mr Batra is an engineer who started his career in 1957 in India with Burmah-Shell owned by the Burmah Oil Company and Shell International Petroleum Co Ltd , and worked in sales, operations, computer systems and operations research In 1976 the company was taken over by the Government and renamed Bharat Petroleum He continued with the organisation and was in charge of the first major expansion of the Bombay refinery since it was commissioned in 1954 He was appointed Director (Marketing) in 1987 and was a full-time member of the Board of Directors responsible for directing All-India marketing policies, the distribution and sale of petroleum products and the execution of marketing projects Bharat Petroleum was one of the 50 international oil companies and one of only 7 Indian Companies that appeared in the Fortune 500 global listing of 1991-92 He was also a Director on the Board of Cochin Refineries

A PERSPECTIVE ON INTERNATIONAL ALLIANCES: DRIVERS & ISSUES

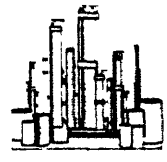
MR STEVEN K WELCH
Vice-President
International Business Development
Amoco Petroleum Products
Chicago, USA



A Perspective on International Alliances: Drivers and Issues

S K Welch
Vice President
International Business Development
Petroleum Products Sector
Amoco Corporation

AMOCO





International alliances are being used extensively

- What is an alliance?
- Why are firms developing international alliances?
- What is the basis for a successful alliance?
- What key issues must be managed to ensure success?

AMOCO



What is an alliance?

- Covers broad spectrum of agreements
- Generally, an arrangement where two firms
  - jointly develop a win-win strategy
  - bring complementary resources
  - pool resources, investments, or risks

AMOCO



Why are firms developing international alliances?

- Experience sharing
- Risk sharing
- Economies of scale
- Access to
  - technology
  - capital
  - skills and capabilities
  - markets

AMOCO



What do domestic firms traditionally bring to international alliances?

- Market knowledge
- Local business skills
- People management skills
- Experience

AMOCO



What does Amoco bring to international alliances?

- Technology skills
  - process
  - product
- Access to capital
- Global business management expertise
- Experience in international markets

AMOCO



What are the key factors in a country's business environment?

- Freedom to operate
- Predictable legal environment
- Technology protection
- Risk capital availability
- Capable workforce

AMOCO



How does it all come together?

- Identify the market opportunities
- Select the "right" partner
  - complementary capabilities
  - compatible cultures
  - common business vision
  - common goals and objectives
- Negotiate an agreement

AMOCO



What are the benefits of international alliances?

- Low cost, high quality products and services for local consumers
- Development of a world-class industry
- Transfer of technology
- Profitable growth for the joint venture owners

AMOCO



Maintaining a strong, balanced relationship

- Clearly articulate goals and objectives
- Mutually establish roles and accountabilities
- Communicate frequently and openly

AMOCO



Giving the venture the necessary autonomy

- Treat joint ventures as independent firms
- Manage strategy, not operations
- Give managers flexibility
- Foster employee allegiance to the joint venture, not the parents

AMOCO



Sustaining success

- Ensure a continued alignment of objectives
- Continue to provide high-caliber employees
- Keep focused on growing the business
- Support expansion beyond the initial vision

AMOCO



Conclusions: International Alliances

- Are effective responses to an increasingly competitive environment.
- Provide win-win means of pooling experience, capabilities, resources, and risks to capture growth opportunities.
- Require strong, balanced relationships between parents

AMOCO

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR. STEVEN K. WELCH
Vice President International Business Development, Amoco Petroleum Products
Chicago, USA

Steven K. Welch has been Vice President of International Business Development for Amoco's Petroleum Products Sector since July, 1994. He is responsible for providing leadership and management direction to define and implement the international strategy of the Petroleum Products sector.

Mr Welch joined Amoco Corporation in May, 1976 as a Senior Financial Analyst and served in several administrative positions for Amoco Chemicals International joint ventures before moving to Taipei, Taiwan in 1981 as Vice President of Finance for China American Petrochemical Company, an Amoco Chemical joint venture with Chinese Petroleum Corporation and Central Investment Holding Company. He was named President of Amoco de Brasil Ltd in Sao Paulo, Brazil in 1983.

Mr Welch returned to Chicago in 1985 as Senior Financial Manager for Amoco Corporation and, in 1987 Mr Welch became Director of Capital Investments for Amoco Chemical. In October, 1989 he became Vice President of Marketing and Sales-Polymers for Amoco Chemical Company responsible for the business direction, sales, and marketing of polypropylene and polystyrene and the polypropylene licensing business. In April 1993 he became Director of Strategic Planning for Amoco Corporation before moving to his current position in 1994.

A native of Savanna, Illinois, Mr Welch earned his bachelor's degree in finance from the University of Illinois and his master's degree in business from Indiana University. He is married with three children, including a recent addition in July, 1995.

FUEL COKING, A TOOL FOR MANY CRAFTS APPLICATIONS FOR INDIA

Mr FRANZ B EHRHARDT
Executive Consultant
Frontier Business Development
Downstream Operations
Conoco Inc
Houston, USA

Paper to be distributed separately

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter Continental Hotel
New Delhi, India

PANEL IX

INFRASTRUCTURAL CHALLENGES

PANEL CHAIRMAN : **DR RAKESH MOHAN**
Economic Advisor
Ministry of Finance
Government of India
(subject to final confirmation)

PANELLISTS : **MR THOMAS E FISHER**
Corporate Vice-President
Commercial Affairs
Unocal Corporation
Los Angeles, USA

MR R A SHANBHAG
Executive Director (Pipelines)
Indian Oil Corporation Limited
New Delhi, India

MR S BEHURIA
Executive Director (Sales)
Bharat Petroleum Corp Ltd
Bombay, India

MR GERRIT STOFREGEN
President
Paktank Asia-Pacific Ltd
Hong Kong

MR M K MISHRA
Advisor (Traffic)
Railway Board
New Delhi, India

RAKESH MOHAN
Economic Adviser,
Ministry of Industry,
Government of India.

THIRD PARTY ACCESS TO PIPELINES: THE US PERSPECTIVE

MR THOMAS E FISHER
Corporate Vice-President
Commercial Affairs
Unocal Corporation
Los Angeles, USA

Paper to be distributed separately

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR THOMAS E FISHER
Corporate Vice President, Commercial Affairs, Unocal Corp
California, USA

Graduate — Texas A & M University 1966
B S in Mechanical Engineering

Joined UNOCAL Corp in 1966 Held various engineering and Management positions both domestically and internationally before being appointed Division Vice President, U S Natural Gas Department October, 1987 Responsibilities for National Gas Sales, Transportation, Administration and Regulatory Affairs were expanded to all of North America in 1989 and worldwide in 1992 In July 1994 appointed Corporate Vice President on Commercial Affairs, responsible for Marketing of UNOCAL's worldwide gas, oil and NGL resources Also, responsible for Development of Electrical Power Projects Acquisitions and Divestitures and significant commercial negotiations

Registered Professional Engineer
Member Executive Committee of Natural Gas Supply Association
Member ITAC Committee of Gas Research Institute
Member and Director Gas Processor's Association
Member of Society Petroleum Engineer
Active in Various Community and Volunteer Organisations

write-up

PORT FACILITIES AND IMPORTS

1 0 BACKGROUND

1 1 Petroleum Products play a major role in meeting the energy requirements of the country along with conventional and non-conventional sources of energy such as power, coal, solar, wind, etc. The growth in petroleum demand would be much higher with the projected faster growth of the economy. The demand for petroleum products is expected to go upto 124 million tonnes within a period of 12 years and almost 50% of this requirement will have to be met through imports. This would require large investments in refining capacity and in expansion of distribution network. These would require to be supplemented in the basic infrastructural facilities such as ports, shipping and other essential services. Some recent studies estimate the requirement of investment in the petroleum sector in the range of $ 40 to 60 Billion within the next 12/15 years to meet the projected demand.

2 0 PORT FACILITIES

2 1 Port infrastructure forms a very vital and crucial part of the over all logistics system of Petroleum Products since the country is not self sufficient and has to depend on import of crude oil and finished products for meeting the demand. The consumption of Petroleum Products has increased from 55 MMT in 1990-91 to 65 6 MMT in 1994-95 and is expected to reach a level of about 69 MMT in 1995-96

2 2 Imports of finished products and crude are handled on West Coast at Kandla, Okha, Bombay, Goa, Mangalore & Cochin and on East Coast at Madras, Tuticorin, Visakha, Paradip, Haldia, Budge Budge & Port Blair Annexure-I shows the Port traffic (Products) handled through the above ports during last five years. The important Ports for product handling are Kandla, Goa, Bombay, Madras, Paradip and Haldia. The main products handled are Naphtha, Petrol, Kerosene, ATF, Diesel, Furnace Oil, Low Sulphur Heavy Stock, etc

2 3 With the projected growth in demand, the pressure on ports for handling higher volumes, is expected to increase in the coming years The Port traffic (products) for next five years is given in Annexure-II. It is, therefore, of paramount importance that the Port Facilities (both by Port Trusts and Oil Industry) are developed/augmented to match the requirements

3 0 COMPONENTS OF INFRASTRUCTURE - WITH PORTS/OIL INDUSTRY

3 1 In the past there has been a gradual expansion of infrastructure at ports. However, during the last five years there has not been any major augmentation in the facilities

- No of jetties for POL handling

- Individual jetty capacity in terms of LOA, beam, displacement, etc.

- Availability of Draft.

- Related operational support like Night Navigation and Pilots

- Pollution control, fire fighting facilities and utilities

OIL INDUSTRY

- Storage facilities at Port terminals

- Docklines of required dia/pumping facilities

- Suitable capacity tankers having required discharge rates

- Evacuation facilities - Rail/Road/Trunk Pipelines

4.0 LIMITATIONS/CONSTRAINTS AT PORTS

4.1 The main constraints in handling the required volumes are enumerated below:-

A. NO. OF JETTIES AND JETTY OCCUPANCY

- The availability of POL jetties at major ports is not adequate to cater to the number of tankers calling at the port for discharge/loading operations. Some of these jetties are shared with non POL traffic and also for parallel marketing cargoes. A statement showing the jetty occupancies is enclosed - Annexure-III. Normally berth occupancy higher than 65% is considered to be saturated. Against this norm, it will be observed that Ports like Kandla, Bombay, Madras and Haldia, which account for maximum port traffic, do not have scope for handling higher volumes till the port facilities are augmented.

B DRAFT, DISPLACEMENT AND TIDE

- The available drafts and displacements allowed at most of the ports lead to reduced parcel sizes, multi-port discharge of tankers, increase in freight due to dead-freighting, additional expenses on lighterage operations, bunching of tankers due to multiplication in number of tankers to be

handled, etc. All this manifests in terms of high incidence of demurrage and increase in unproductive time at jetty reducing the capacity of the port to handle traffic Above all it causes inflexibility in the system leading to inability in meeting peak season requirements when the volumes shoot up considerably

Parcel sizes at Kandla, Bombay, Goa, Haldia and Budge Budge are curtailed due to draft restrictions. The berthing/unberthing of tankers at these ports is also governed by Tide as these are Tidal ports

C AVAILABILITY OF NIGHT NAVIGATION/PILOTS

- The availability of operational support like Night Navigation and Pilots has a direct bearing on the utilization of port capacity. In the absence of Night Navigation, the tankers are not allowed to berth or unberth during night time which increases the unproductive occupancy of the berth This also leads to detention of the incoming/waiting tankers.

In other words even when physical capacity is available, the actual port traffic gets restricted on account of lack of Night Navigation Similarly the lack of Pilot support leads to unwanted detention and under utilization. Presently Night Navigation is not available at Kandla, Cochin and Haldia/Budge Budge Restricted Night Navigation is available at Goa and Vizag. Regular night navigation is available only at Bombay and Madras.

D PIPELINE/PUMPING FACILITIES

- At some ports like Kandla and Bombay the pipelines are owned and operated by the ports and at other locations by the Oil Industry Over a period of time the Dockline system has been upgraded to match the requirements The major pipeline constraint is at Bombay where the sub-marine pipelines are over 40 years old Bombay Port Trust have now undertaken the proposal for replacement which will take approx 3 years for completion.

The Shore pumping facility for loading tankers for coastal movement/exports is also a limiting factor which results in higher jetty occupancy on account of lower pumping rates The length of pipeline (varying from 5 KMs at Bombay to 12 KMs at Madras) also has a bearing on the loading rates Similarly the long lead between jetty and Industry terminals affects the tanker discharge rates e.g Kandla Main Terminals 11 KMs However the Fore Shore Terminals at Kandla (distance 1.5 KMs), Bombay MOT (distance 0.5 KMs) and Madras FST (distance 2 KMs) provide faster discharge/loading rates due to proximity to the jetties

E STORAGE FACILITIES

- Oil Industry tankages at Port locations have been augmented from time to time for handling higher volumes Additional tankages under APT Programme have been put up at Kandla, [illegible] existing coastal tankages are given in Annexure-IV The storage normally provides adequate cover for receipt/loading of tanker parcel sizes and product evacuation However, the tankages at locations like Bombay, Mangalore, Madras FST Haldia, etc need to be reviewed for augmentation

F EVACUATION FACILITIES

- Oil Industry has put facilities for evacuation by Rail, Road and Pipeline at the Port locations to expedite despatches in line with the demand at upcountry locations. The Kandla-Bhatinda Pipeline is expected to be commissioned during end 1995 which will provide a regular input into the land-locked Northern Region.

  Any delay in product evacuation from the coastal locations leads to lower inventories in the hinterland as well as lack of ullage for tanker receipts resulting in detention Railways play a major role in product evacuation in terms of availability of tank wagons at the loading bases

5 0 KNOWN PLANS FOR AUGMENTATION OF PORT FACILITIES

KANDLA

BY PORT TRUST

- Construction of Third Oil Jetty.

BY OIL INDUSTRY

- Construction of 'Virtual Jetties' by IOC and HPC

- Lighterage operations (already commenced)

BOMBAY

BY PORT TRUST

- Replacement of sub-marine pipelines between Jawahar Island and Main land in the next 3 years

- Completion of new Pir Pau jetty with higher draft availability for handling LPG, Naphtha and Chemical tankers

BY OIL INDUSTRY

- Laying of higher dia pipelines commensurate with the replacement of sub-marine pipelines by BPT

- Provision of higher dia pipelines from the new Pir Pau jetty

MANGALORE

BY PORT TRUST

- Development of new POL jetty for handling crude/product tankers along with the commissioning of Mangalore Refinery.

COCHIN

BY PORT TRUST

- Increase in draft at COT from the existing 10 mtrs. to 12 mtrs

BY OIL INDUSTRY

- Optimum utilization of Irumpanam terminal for product storage/loading of tankers including exports and coastal movement

PARADIP

BY PORT TRUST

- Development of new oil jetty as against the existing jetty which is shared with other cargoes

BY OIL INDUSTRY

- Construction of Lighterage Terminal by IOC, expected commissioning in mid 1995 Existing Paradip Terminal of HPC is grossly underutilized for want of required draft to handle full tanker parcels.

6.0 THRUST AREAS FOR DEVELOPMENT OF PORT INFRASTRUCTURE

6.1 Development of new port terminals and coastal storage tanks

6.2 Deeper drafts at major ports like Kandla, Goa, Cochin, Vizag, Haldia and Budge Budge.

6.3 Putting up SBMs and Captive Oil Berths

6.4 Sizing of docklines matching the higher pumping capacity of new generation tankers

6.5 Augmentation of evacuation facilities from coastal storage to inland consumption zones

6.6 Related support system like Night navigation, Pilotage, Computerised cargo handling, etc

6.7 Development of oil spill combat facilities to protect the coasts

ANNEXURE - I

PORT TRAFFIC (PRODUCT)
1990-91 TO 1994-95

FIGS IN MT

PORTS	90-91	91-92	92-93	93-94	94-95
KANDLA	4102	4766	5443	5622	6640
OKHA	91	114	132	140	145
BOMBAY	4428	4546	4246	4302	4390
GOA	970	1125	1152	1185	1822
M'LORE	590	644	615	830	874
COCHIN	1206	1147	954	1172	1442
T'CORIN	484	490	503	417	400
MADRAS	2353	2988	3496	3649	4134
VTSAKHA	1094	1703	2117	1481	2382
HALDIA	2947	3200	3809	3458	3962
B-BUDGE	588	625	1233	1163	1759
P'BLAIR	52	43	59	58	113
PARADIP					183
ALL PORTS	18903	21391	23759	23255	28226

ANNEXURE-II

PORT TRAFFIC (PRODUCTS) PROJECTIONS
(1995-96 & 1999-2000)

FIG IN TMT

PORT	1995 96	1999-2000
VADINAR	0	7214
BOMBAY	4243	5470
KANDLA	8118	447
VASCO	1292	1176
MANGALORE	836	1842
COCHIN	1924	1789
TUTICORIN	420	368
MADRAS	4126	584
VIZAG	2200	2867
HALDIA/BGB	5326	2402
PARADIP	380	338
	28845	24297

NOTE : The above projections assume the following new Refineries/expansions coming up :

Refinery	Capacity (MMT)	Commissioning Period
BRPL (expansions)	1 0	1995-96
Mangalore	1.5 3.0	1996-97 1997-98
Panipat	5.7	1998-99
Reliance	5 4 9 0	1998-99 1999-2000
Central India	3.6	1999-2000

ANNEXURE - III

JETTY OCCUPANCY AT MAJOR PORTS

FIGS. IN % AGE

PORT	1992-93	1993-94	1994-95
KANDI A	83	78	80
BOMBAY	80	85	90
GOA	84	85	88
MADRAS	71	75	76
VIZAG	69	71	79
HALDIA	64	63	63

ANNEXURE-IV

COASTAL TANKAGES

FIGS. IN 1MT

LOCATION	GROSS TANKAGE
WEST COAST	
KANDLA	469.8
OKHA	22.5
BOMBAY	935.6
VASCO	94.4
MANGALORE	48.1
COCHIN	552.5
S. TOTAL	2112.7
EAST COAST	
MADRAS	552.5
VIZAG	436.4
PARADIP	40.0
HALDIA	356.0
BUDGE BUDGE	172.5
PORT BLAIR	21.9
S. TOTAL	1579.3
GRAND TOTAL (WC + EC)	3692.0

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR S BEHURIA
Executive Director (Sales), Bharat Petroleum Corp L
Bombay, India

Qualifications	B A (Hons) - Economics St Stephen's College, New Delhi
	M B A - IIM Ahmedabad
Experience	Joined Burmah Shell in June 1973 After an initial posting in Finance and Planning Departments, mostly worked in the field of Sales, Personnel and Distribution Functions
	Has been Director (Operations), Oil Coordination Committee for a period of 2½ years where he interacted very closely with Port Authorities, Railways Shipping Industry etc Has very wide experience in all functions in the Oil Industry

INTERNATIONAL OIL STORAGE OPERATORS PERSPECTIVE

MR GERRIT STOFREGEN
President,
Paktank Asia-Pacific Ltd
HongKong

International Oil Storage Operation Perspectives - Infrastructural Challenges

- In discussion to day's subject with you I like to introduce our company and its development in handling liquid products.
- This background allows me to illustrate not only where we and our industries are coming from, but also where we are likely going to, our perspective and challenges, since history largely repeats itself although sometimes well disguised.
- Royal Pakhoed N.V. of Rotterdam is the parent company.
  In 1616 one of the companies forming Royal Pakhoed today was officially recognised in an ordinance on port activities and even specifically mentioned in a play by a wellknown dutch dramatist in the same year.
  The company's logo - the red hat - dates back to those days, when people working in the various port companies turned to the sirple but effective expedient of wearing different coloured hats to identify themselves.

  By the way those who may have visited The Netherlands and more in particular a place called Alkmaar - famous for its cheese - may have noted that the cheesebearers in that city still wear colcured straw hats.

  Paktank represents the company's engagement in the handling of crude oils, petroleum products, chemicals and gases.

Also here the company has historical roots.

The first oil handled by any company in Rotterdam was by our organisation in 1863 when a cargo of crude oil, then still called rock oil, packed in wooden barrels was stored at the company's special built warehouses. It was the start of a new activity indeed.
In 1877 the company dedicated a special site in the port and in 1888 it took its first storage tanks into operation.

In 1904 The Petroleum Review commenting on a visit to Rotterdam and our company reports: "Undoubtedly the company is operating one of the best equipped terminals around and as a pioneer in this field deserves a special attention".

- Since then the terminalling industry, like many other activities has developed from what I would like to call a trade into capital intensive, highly technical and environmental caring industry, employing people whose professional education training and experience equals the operators employed in the refinery industry and big chemical plants.

- For long, transport economics have been a driving force in a location choice.
The development in sea transport and inland transport

requirements, for instance container shipment, and for our industry the large crude carriers, the 80.000 dwt product tankers, the highly sophisticated chemical parcel tankers, pipelines etc. have dramatically changed transport economics and consequently the requirements in facilities expected from the ports and its facility providers.

Some ports - like Rotterdam - have found a timely and adequate reply to these changes and as consequence been rewarded by continuous growth and prosperity.

Rotterdam not only handles approx. 120 million tons of crude oil and petroleum products per year but has developed into a major refinery and chemical manufacturing centre.

In coping with changing circumstances the refineries, chemical plants and independent terminals moved away from the city towards the sea, to deeper water.

- Today in Rotterdam, Port Authority, City Government and private enterprise are still closely cooperating to use any opportunity to optimise on the port's strategic location by improving the total set of services.
These developments have lead to substantial integration of facilities of the industry with those of the terminal operator such as pipeline connections between plants and

terminal, transfer of operations to terminal operations.

- Moreover and increasingly and not only in Europe the petroleum and the chemical industry have come to the conclusion that it is much to their advantage to concentrate only on their core business and transfer their existing and their new terminalling and logistic requirements to the professional independent terminal operator. No further capital commitment and joining economics of scale and expertise are clear advantages.

- Can some of the features pictured serve to draw an analogy as to what can be expected elsewhere?

- Strong and continuous growth in energy demand in the Asia Pacific area at large, necessitates the import into the area of both crude oils and petroleum products, interregional product flows will grow and further develop, with the growing demand for chemicals as well, increasing quantities of liquid chemicals are being transported. The developments have often fully outpaced existing port facilities, their infrastructure and that of the hinterland.

- Again transport economics will be a major driving factor in location choice. But not only seatransport economics are determing the choice, infrastructural inland components and industrial climate play their role as well.

Reliable information on ports, rivers, roads, railways, governments, timeplanning, capacities and demand, regulations to name a few is not often available. In entering the Asia Pacific region we are often sailing unchartered territory, exploring, in our function of infrastructural developers how to serve best the logistic and industrial requirements of a particular port or region.

As an operator we stand for:

- independence
- economic/market positioning for our users
- flexibility in jetty and terminal operations
- safety, quality and environmental care
- integrated services
- specific client programmes
- to be a trustee for the clients product, recognized by the financial institutions.

As an operator we look for:

- Main ports
- Deep draught
- Hinterland - coastal redistribution
- Business environment/industrialisation
- Cooperation Port Authority and other officials.

Independent terminalling activities are not always well understood by authorities and parties we talk to when studying new ventures.

ders, but providers of high quality logistic services, creating opportunities for 3rd parties be it trade/industry or a porteconomy at large.

This can best be exemplified by the developments in Singapore. It becomes difficult to realize that many considered the arrival of the independent storage operators in Singapore an ill conceived idea in the early 80's.

The presence of independent terminals and the active support of the Port of Singapore Authority resulted amongst others in a growth of the bunker oil market upto 1986 having with an approx. annual volume of 5-6 million tons served through refinery facilities only - to a volume of over 16 million tons per year today. The traditional oil companies are still having a lions share of this volume. It will be clear to you that many other activities in Singapore benefitted from this development as well and that the independent facilities have greatly contributed to Singapore becoming the major market place East of Suez.

Transport economics, integrated services, blending possibilities, breaking bulk, redistribution are creating volume and opportunities.

In the Asia Pacific area, where much infrastructured changes and expansions are needed to meet the required economic growth, the long term perspective for an independent storage operator bringing a new product to the market is certainly encouraging. However euphoria would

be misplaced. It is not an easy way but a real major infrastructural challenge.

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

MR. GERRIT STOFREGEN
President
Paktank Asia-Pacific Ltd,
Hong Kong
Executive Director,
Paktank International B V

Gerrit Stofregen is an Executive Director of Paktank International B V and President of Paktank Asia Pacific based in Hong Kong

He is also responsible for Paktank operations in the Asia-Pacific - Singapore (Tankstore), Thailand (Thai Tank Terminal Eastern Seaboard Industrial Estate, Rayong) and in Xiamen Fujian Province PRC (Xiamen Paktank) of which the construction has just started

Mr Stofregen is also looking after the development of new terminalling facilities and logistic services in the area

DR FEREIDUN FESHARAKI
Director, Program on Resources
East-West Center, Hawaii
Past President,
International Association for Energy Economics

CONFERENCE CO-CHAIRMAN

The First Annual Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR. FEREIDUN FESHARAKI
Director, Program on Resources, East-West Center
Past-President, International Association for Energy Economics

Dr Fereidun Fesharaki is the Director of the Program on Resources, East-West Center, Honolulu, Hawaii. Born in Iran, he received his Ph D in Economics from the University of Surrey in England. He then completed a Visiting Fellowship at Harvard University's Center for Middle Eastern Studies. In the late 1970's, he attended the OPEC Ministerial Conferences in his capacity as Energy Adviser to the Prime Minister of Iran. He joined the East-West Center in 1979.

His area of specialization is oil and gas market analysis and the downstream petroleum sector, with special emphasis on the Asia-Pacific region, Middle East, Latin America and the United States. He has been an adviser to a number of major oil companies, independant companies, trading companies, state-owned oil companies and governments in the Middle East, Pacific Basin and Latin America, as well as the U S government.

Dr Fesharaki is the author of more than 70 papers and has authored or edited twenty three books and monographs the latest of which are *Japan's Long-Term Petroleum Supply Strategy: Policy Options for the Government and Industry* (in Japanese, 1993) International Issues in Energy Policy, Development and Economics (Westview Press, 1992) *Fundamentals of Petroleum Trading* (Praeger 1991), *Developments in the Global Oil Market: Implications for the Asia Pacific Region* (in Japanese, 1991), *Energy Market and Policies in ASEAN* (ISEAS, Singapore 1991), *Economic and Political Incentives to Petroleum Exploration: Developments in the Asia Pacific Region* (University Press of America, 1990), *The Oil Market in the 1990s: Challenges for the New Era* (Westview Press, 1989), *OPEC and Lower Oil Prices: Impacts on Production Capacity, Export Refining, Domestic Demand and Trade Balances* (U S Department of Energy, 1989) *Electricity in Asia and the Pacific: Power Station Fuel Demand to 2000* (Economist Intelligence Unit, 1989), *Spot Oil, Netbacks and Petroleum Futures* (Economist Intelligence Unit, 1987), and *China's Petroleum Industry in the International Context* (Westview Press, 1986).

Dr Fesharaki is Past President of the International Association for Energy Economics (IAEE), which is the key professional organization representing over 3,000 energy economists in more than 70 countries. He serves on the editorial board of the *Energy Policy Journal*, *Hydrocarbon Asia* and *International Energy and Resources Law and Policy Series*. In 1989, Dr Fesharaki was elected a member of the Council on Foreign Relations. Since 1991, he has been a member of the Advisory Board of Mitsubishi Oil Company of Japan. He is also an Advisory Board member of the Far East Oil Price Index. Dr Fesharaki is President of Fesharaki Associates Consulting and Technical Services Inc., through which he is involved in advising many governments and private companies on issues relating to the petroleum market.

DR R K PACHAURI
Director
Tata Energy Research Institute
New Delhi, India

CONFERENCE CO-CHAIRMAN

The First Annual

Indian Oil & Gas Conference

September 24 to 26 1995, Taj Palace Inter-Continental
New Delhi, India

BIODATA

DR R K PACHAURI
Director Tata Energy Research Institute
New Delhi, India

cademic Qualifications

h D (Economics) and Ph D (Industrial Engineering)-North Carolina State University Raleigh, North Carolina, U S A

I S (Industrial Engineering - major, Economics - minor) - North Carolina State University, Raleigh North Carolina SA

raduate - Institution of Production Engineers London, U K
raduate - Institution of Mechanical Engineers London, U K

Work Experience

irector, Tata Energy Research Institute, New Delhi India April 1981 onwards
dviser (Energy and Sustainable Management of Natural Resources), United Nations Development Programme UNDP), Part Time, June 1994 onwards
isiting Fellow The World Bank Washington D C June 1990 - Sept 1990
enior Visiting Fellow Resources Systems Institute East-West Center Honolulu U S A May 1982 - June 1982
isiting Professor Resources Economics College of Mineral & Energy Resources, West Virginia University Morgantown, West Virginia, U S A Aug 1981 - Aug 1982
irector, Consulting and Applied Research Division, Administrative Staff College of India, Bella Vista, Hyderabad India July 1979 - March 1981
Member, Senior Faculty Administrative Staff College of India, Bella Vista, Hyderabad India June 1975 - June 19
Assistant Professor, Department of Economics & Business North Carolina state University Raleigh North Carolin, U S A , Aug 1974 - May 1975
President, Solar Energy Society of India (SESI) 1990 onwards
President, Asian Energy Institute 1993 onwards
President (1988) and Chairman (1989 - 90) International Association for Energy Economics

Membership of Committees & Boards

Member, Energy Policy Committee, Planning Commission Government of India August 1995 Onwards
Member of the International Solar Energy Society,(ISES) 1991 onwards
Member World Resources Institute (WRI) Council 1992 onwards
Member, World Energy Council (WEC), London 1990-1993
Member , Climate Institute, Washington DC 1994 onwards
Chairman Work Group A - WEC Committee on Developing Countries 1993 onwards
Member Technical Committee on Wastelands Development, Government of India, September 1994 onwards
Member, National Environment Council, Government of India under the chairmanship of the Prime Minister of Indi November 1993 onwards
Member, 'R' Group (Restructuring of Oil Industry) Government of India, Ministry of Petroleum & Natural Gas December 1994 onwards
Chairman, Sub-group of the Working Group on Energy Conservation for the Eighth Plan, set up by the Planning Commission, Government of India, 1989-90
Member, Advisory Board on Energy (ABE) Government of India, 1983-1988 (The Board reportedly directly to th Prime Minister of India)

Author of 19 books and several papers & articles

CONFERENCE EVALUATION
INDIAN OIL AND GAS CONFERENCE
TAJ PALACE INTERCONTINENTAL
NEW DELHI, INDIA

Company _____

_____

Fax _____

(1) Excellent (2) Very Good (3) Good (4) Satisfactory (5) Poor

OVERALL ASSESSMENT OF IOGC '95

SERVICES

Staff	1	2	3	4	5
Conference Documentation	1	2	3	4	5

PANELS COVERED

Please evaluate content and presentation -

PANEL ONE INDIA'S ROLE IN THE WORLD OIL MARKETS

a) Mr John P Fernter	1	2	3	4	5
b) Mr D C Lahiri	1	2	3	4	5
c) Dr Fereidun Fesharaki	1	2	3	4	5

PANEL TWO OUTLOOK FOR EXPLORATION AND UTILISATION OF OIL AND NATURAL GAS IN INDIA

a) Mr K K Kapoor	1	2	3	4	5
b) Dr John Doran	1	2	3	4	5
c) Dr Narsi Ghorban	1	2	3	4	5

PANEL THREE DE-REGULATION AND PRIVATISATION IN ASIA SOME PERSPECTIVES

a) Mr Shamsul Azhar Abbas	1	2	3	4	5
b) Mr Prasert Bunsumpun	1	2	3	4	5

PANEL FOUR FINANCING OIL AND GAS PROJECTS IN INDIA

a) Dr Anil Malhotra	1	2	3	4	5
b) Mr D M Gray	1	2	3	4	5
c) Mr Anthony M Dols	1	2	3	4	5
d) Dr C S Chung	1	2	3	4	5
e) Dr A Bhattacharya	1	2	3	4	5

PANEL FIVE OUTLOOK FOR NEW REFINING CAPACITY

a) Mr S N Mathur	1	2	3	4	5
b) Mr S N Jha	1	2	3	4	5
c) Mr Everett Lewis	1	2	3	4	5
d) Mr Lars Reierson	1	2	3	4	5

PANEL SIX. DOMESTIC MARKETING IN INDIA

a) Mr Vikram Singh Mehta	1	2	3	4	5
b) Mr O N Marwaha	1	2	3	4	5
c) Mr A P Chaudhri	1	2	3	4	5
d) Mr Peter M Roberts	1	2	3	4	5

PANEL SEVEN. OUTLOOK FOR CRUDE AND PRODUCT TRADE

a) Mr S C Mathur	1	2	3	4	5
b) Mr Trevor Christmas	1	2	3	4	5
c) Mr C Madison Galbraith	1	2	3	4	5

h) **PANEL EIGHT: PERSPECTIVES FROM INTERNATIONAL OIL COMPANIES**

a)	Mr Steven K Welch	1	2	3	4	5
b)	Mr Franz B Ehrahardt	1	2	3	4	5

i) **PANEL NINE: INFRASTRUCTURAL CHALLENGES**

a)	Mr Thomas B Fisher	1	2	3	4	5
b)	Mr R A Shanbhag	1	2	3	4	5
c)	Mr S Behuria	1	2	3	4	5
d)	Mr Gernt Stofregen	1	2	3	4	5
e)	Mr Shantu Narain	1	2	3	4	5

4) HOW DID YOU COME TO HEAR ABOUT THIS CONFERENCE?

( ) Conference Brochure ( ) Friends / Business Associate
( ) Our Speakers ( ) Our Supporters Please specify _____
( ) Others Please specify _____

5) WHAT SPECIFIC INFORMATION WAS OF GREATEST VALUE TO YOU? _____

_____

6) REASON FOR COMING TO THIS CONFERENCE
( ) Location ( ) Speakers ( ) Topics ( ) Networking ( ) All

7) WHICH AREAS OF THE ABOVE WAS NOT UP TO YOUR EXPECTATION

_____

_____

8) WHAT OTHER CONFERENCE TOPICS WOULD BE OF INTEREST TO YOU?

_____

_____

9) NAME OF THER PROFESSIONAL COLLEAGUES WHO MAY LIKE TO BE KEPT POSTED OF OUR FUTURE EVENTS

Name _____ Name _____

Designation _____ Designation _____

Company _____ Company _____

Address _____ Address _____

_____

_____

THANK YOU FOR YOUR EFFORT

PLEASE MAIL THIS FORM TO 151A THOMSON ROAD, GOLDHILL CENTRE, SINGAPORE 307606

OR

FAX TO: (65)-3560962